THE IMPACT OF PLAYGROUND MARKINGS ON THE PHYSICAL ACTIVITY LEVELS AND PLAY BEHAVIOURS OF FOUNDATION STAGE CHILDREN

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Abstract

***Background**:* Levels of inactivity amongst children are increasing, having a profound impact on health. Prior research suggests that this issue of inactivity is becoming more prominent from the early years of childhood (5 years and under). School playtime is highlighted as a prime opportunity for foundation stage children (3-5 years) to engage in active free-play. Painted playground markings are a proposed stimulus to engage children in physically active, social and creative play (Stratton and Mullan, 2005; Ridgers *et al.,* 2007).

Objective: The aim of this research is to identify if the installation of painted playground markings has an impact on the physical activity levels of Foundation Stage children during playtime. Identifying if the intervention encourages inactive children to engage in higher intensities of physical activity and any effect on play behaviours.

***Method**:* A comparison of 2 schools with painted playground markings to 2 schools with no markings. The physical activity and play behaviours of 77 foundation stage children (*M* = 55 months ± 7 months, *N* = 39 male) from 4 schools was assessed through the implementation of a multi-method research design. Actigraph accelerometers, the observation tool System for Observing Children's Activity and Relationships during Play (SOCARP) and semi-structured Interviews with school staff were all utilised.

Results: No significance ($p>0.05$) for markings affecting the levels of the participant physical activity. Interviewees stated that markings had a limited impact. Participants engaged in small groups, locomotor activity and little or no social interactions with their peers. Participants spent 38% (*mean*) of playtime in moderate-vigorous activity.

Discussion: No significance ($p>0.05$) between schools and the amount of time spent in physical activity intensities. Participants perceived to be too young to know how to interact with and play on the markings. Interviewees stated gendered perceptions of play dynamics. There is an evident need for associated playground training to maximise the use of markings for this age group.

Conclusion: *S*cope to combine markings with guidance from supervisors/young leaders (post the associated training), equipment and playground structures to create an optimum playground environment to encourage the active play of foundation children.

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Table of Contents

List of Tables

List of Figures

List of Abbreviations

PA - Physical Activity

LIG - Light

SED - Sedentary

MOD - Moderate

VIG - Vigorous

LPA - Light Physical Activity

MVPA - Moderate to Vigorous Physical Activity

VPA - Vigorous Physical Activity

LMVPA - light, moderate, vigorous physical activity

NHS - National Health Service

SOCARP - System for Observing Children's Activity and Relationships during Play

OSRAC-P - Observational System for Recording Physical Activity in Children-Preschool Version

SOPLAY - System for Observing Play and Leisure Activity in Youth

UK - United Kingdom

AM - Morning

MD - Midday

PM - Afternoon

CARS - Child Activity Rating Scale

BMI - Body Mass Index

1. Introduction

Play is increasingly being recognised as essential to a child's early development. This is supported by existing literature which highlights play and play of a physically active nature to have an encompassing and positive impact, effecting cognitive, physical, social and even emotional advancement from an early age (Malina, 1996; Bjorklund and Brown, 1998; Pica, 2003; Burdette and Whitaker, 2005; Rink *et al.*, 2010; Brockman *et al.,* 2011). A child's early years defined as up to the age of 5 years (Chief Medical Officers, 2011).

Research suggests that rising levels of inactivity amongst children have an inverse relationship with health and wellbeing (Pica, 2003; Lobstein *et al.,* 2004; Jago *et al*, 2005; Burdette and Whitaker, 2005; Ridgers *et al, 2007;* Brown and Summerbell, 2009). Consequently, focus on the physical activity levels of young children is becoming more prominent. Studies highlight that over the last two decades the proportion of time children spent in a sedentary state has significantly increased (Ridgers *et al., 2007;* Loprinzi and Cardinal, 2011). This increase in sedentary behaviours is attributed to several factors such as developments in technology (i.e. increased screen time in watching television/playing videogames; Lindon, 2001); individuals being less physically mobile and engaging in less active travel (i.e. driving instead of walking/biking to school); lack of encouragement to engage in physically active play from influential adults (Brustad, 1993); health, safety and risk concerns of play by adults (Bundy *et al.,* 2009); reduced access and opportunities to facilities and suitable play environments; as well as socio-economic status reported to being a barrier to active play (Nielson *et al.,* 2012).

Inactivity and sedentary behaviour are terms that are often used interchangeably; however have differing definitions (Pate *et al.,* 2008). There now exists a spectrum of recognised activity intensities utilised by researchers to precisely document participants physical activity levels; ascending in intensity from sedentary, light, moderate to vigorous activity. Sedentary behaviours such as sitting and reading can be differentiated from light and moderate activities like floor play. It is important for researchers in the field to recognise that the term sedentary behaviour refers to activities that do not increase energy expenditure above the individuals resting level such as when sitting, lying down, sleeping or when watching screen-based entertainment (Pate *et al.,* 2008). Light to vigorous activity denote constructs that involve an individual expending energy above their resting level with an inactive individual considered to participate in low or insufficient levels of moderate to vigorous activity (British Heart Foundation, 2012).

This increase in habitual sedentary behaviours is linked to the rising trend of inactivity amongst children, with low levels of physical activity suggested to be a major contributing factor to the obesity epidemic entrenched in western society (Lobstein *et al.,* 2004; Pate *et al.,* 2004; Stellino *et al.,* 2009*;* Brown *et al.,* 2009). In addition to issues of excessive weight gain and obesity, inactive behaviours are reported to be connected with co-morbidities and serious health problems such as diabetes, osteoporosis, sleep apnoea, depression and the development of chronic diseases; all of which are documented to becoming increasingly evident in the earlier stages of the life course (Torpy, 2010). Studies are beginning to question the impact of inactivity from a young age on health and weight gain (Ridgers *et al*., 2007, Brown *et al*., 2009; Brown and Summerbell, 2009; Oliver *et al*., 2007). A review of

preschool aged (≤5 years) children's physical activity conducted by Oliver *et al.,* (2007) states that it is evident 'obesity, inactivity and physical activity may all track from childhood to adolescence and adulthood'. This calls for research into activity during the early years of life in order to underpin if young children (≤5 years) are physical inactive.

Field studies (Lobstein *et al.,* 2004; Almqvist *et al*., 2006; Pate *et al.,* 2004; Heaton-Harris, 2009) have identified that sedentary behaviour patterns accepted as the norm in childhood can persist into adulthood; significantly increasing the likelihood of individuals having health problems in the later stages of life. This emphasises the need for interventions to encourage positive and enjoyable engagement in physical activity from an early age to encourage the development of habitual behaviour. This is further supported by study into the dynamics of children's play as research states that a positive relationship exists between active play and health (Stellino *et al.,* 2010; Ridgers *et al.,* 2006; Oliver *et al.,* 2007). Emphasis is placed on the importance of engaging children in physical activity from a young age in order to develop positive schemas and attitudes towards engaging in physical activity, as Hinkley (2008) states that inadequate participation in physical activity may mean that young children become more susceptible to preventable health conditions. Therefore, preventative interventions to increase physical activity levels and encourage opportunities for active play are becoming more prominent in play environments, and in turn a need for well-informed studies to evaluate such interventions designed to promote physical activity and active play (Pate, 2001).

Active play is not only described to be beneficial for general health but also to wider aspects of early development; impacting on well-being (Lobstein *et al.,* 2004; Stellino *et al,*. 2010) and the associated dynamics of learning key motor skills, progressing cognitive abilities and learning how to build social relationships (Ramstetter *et al*., 2010). Consequently, the NHS (National Health Service) has developed physical activity guidelines for young children. These guidelines are relevant to the focus age group in the present study; children aged 3-5 years in the foundation stage of primary school. The latest national guidelines (Chief Medical Officers, 2011) outline recommendations for the types and levels of physically active play young children should engage in on a daily basis; 180 minutes of light to vigorous physical activity. The sporadic nature of young children's active play (Burdette and Whitaker, 2005; Ward *et al.*, 2007) is reflected in the guidelines as the physical activity outlined may consist of varied intensity bouts spread intermittently throughout the day. There is however, as previously highlighted, a call for further research to determine whether early year's children are meeting these recommendations, with a need for more understanding about their PA (Physical Activity) levels, play behaviours and play environments (Hinkley et al. 2008; Pate et al. 2004); therefore contributing to knowledge of effective interventions.

Study in the area of young children's active play is limited (Oliver *et al*., 2007; Ridgers *et al.,* 2007, Pate *et al*., 2008) which is in contrast to the wealth of literature that currently exists in relation to interventions and the impact of inactivity in older children (≥5 years) and adults, as Pate *et al*., (2008:439) suggest that 'relatively little is known about the physical activity levels' of younger children. Oliver *et al.,* (2007) emphasise the need to focus research on

physical activity levels in the early years of childhood and to identify interventions and methods to engage young children in physical activity.

Young children are likely to participate in physical activity in a number of varying contexts. The school playground is highlighted as a principal environment for young children to engage in frequent active play on a daily basis (Ramstetter *et al.,* 2009; Hinkley *et al.,* 2008; Ridgers *et al.,* 2007). Opportunities for activity outside of school may be more limited (Bundy *et al.,* 2011) and dependent on a child's individual home environment, where it can also be difficult to measure the impact of interventions. The school setting presents an environment where a single intervention has the potential to impact a mass number of children.

For Foundation Stage children the vast majority of primary schools in the UK (United Kingdom) hold morning, lunchtime and afternoon outdoor playtimes, equating to around 45-60 minutes per day, 5 days a week, 39 weeks of the year. This allows for everyday opportunities for children to engage in free or structured, active, social, creative and education based play. Previous interventions aiming to increase physical activity levels on the school playground have primarily focussed on encouraging activity and interaction with the playground by changing the environment through making various types of play equipment available (Bundy *et al.,* 2009; 2011; Stellino *et al.,* 2010), installing play facilities (Hannon *et al.,* 2008; Nielson *et al.,* 2012), zoning the school playground and installing playground markings (Health Promotion Wales, 1997; Stratton, 2000; Stratton and Mullan, 2005; Ridgers *et al.,* 2007; 2010; Cardon *et al.,* 2009; Blaes *et al.,* 2013). Alternative adaptations have focussed on how playtimes are run through the introduction of playground

leaders (older children who are selected to initiate and engage younger children in active games), time management of play periods and linking Physical Education lessons with playtime activities (Janssen *et al.,* 2011).

The playground is an important environment for children to engage in physically active and social free play. A study by Pate *et al.,* (1996) concluded that children are more likely to engage in MVPA (moderate-vigorous physical activity) in unstructured play settings where they are free to interact with their play area and their peers. This is supported by research (Ridgers *et al.,* 2006) which found that playtime can contribute between 5-40% of children's recommended physical activity levels when there are no interventions present; however this is stated to be dependent on several impacting factors such as child gender, seasonal effects and child play preferences. Moreover research conducted by Ridgers *et al.,* (2006; 2007; 2010) supports the hypothesis that playground based interventions can be effective in providing further opportunities for increasing levels of physical activity whilst maintaining children's ability to play freely. Therefore the introduction of a school based intervention aimed at providing a stimulus to encourage the active play of Foundation Stage children within the playground has the scope to increase activity levels and contribute to young children meeting PA recommendations.

One such playground intervention proposed to be a stimulus to engage children in physically active, social and creative play are multi-coloured painted playground markings (Stratton *et* al., 2005; Ridgers *et al.,* 2006; 2007; 2010; Cardon *et al*., 2009; Bleas *et al.,* 2013). A limited number of school based studies have directly evaluated the effect of installing multi-

coloured painted playground markings on the physical activity levels and play behaviours of children (Health Promotion Wales, 1997; Stratton, 2000; Stratton and Mullan, 2005; Ridgers *et al.,* 2007; 2010; Crust *et al.,* 2014). However, no studies have explored the impact of this intervention on foundation stage children's activity. Multiple studies have reported painted playground markings to have a positive effect on engaging older children and increasing levels of energy expenditure and physical activity (Table 1).

Table 1: Intervention studies reporting a positive impact of markings on participant physical activity

Study	Reported effect of markings on participant PA	Age range
Stratton (2000)	Increase of 18 minutes per day spent in Moderate-vigorous PA	4-11 years
Stratton and Leonard (2002)	35% increase of energy expenditure	5-7 years
Stratton and Mullan (2005)	Up to a 50% increase in vigorous physical activity	5-11 years
Ridgers *et al.,* (2007)	4% increase of moderate-vigorous physical activity	7-8 years
Blaes *et al.,* (2013)	Significant ($p<0.05$) short term impact on increasing PA levels	6-11 years
Crust *et al.,* (2014)	7.5% increase in observed physical activity	10-11 years

As shown in Table 1, markings have a reported positive impact on the PA of children in primary school (5+ years of age) and are a proposed intervention to stimulate play and engage foundation stage children (3-5 years) in physical activity. Sedentary lifestyle behaviours are reported to be apparent once children reach the age of 3-4 years (Reilly and Dorosty, 2000), highlighting the early years as a significant period to engage children in active behaviours.

The primary aim of this research is to identify if the installation of painted playground markings (multi-skill training zone package, see appendix figure 1) as part of a county-wide initiative by the Centre for British Teachers and key partners have a positive impact on the physical activity levels of Foundation Stage children during playtime in getting inactive children engaging in higher intensities of physical activity. The secondary objective of this study is to ascertain how active Foundation Stage children are within the school playground and to what extent playtime contributes to children participating in the daily activity recommendation of 180 minutes. Additionally, this research aims to cast light on the dynamics of young children's play behaviours within the school playground (activity types and social interactions) and determine if the installation of markings are a catalyst for any changes to the type and frequency of play activities and social interactions of participants.

The subsequent chapters aim to outline and examine the current literature within the field of children's physical activity and play, discuss previous interventions set out to increase activity levels within the school playground and the research methods implemented, the literature will be critiqued. The theoretical underpinnings and justification for the study methodology implemented and research design will be discussed and overcoming the challenges and limitations found in combining multiple methods in the pursuit of maximising understanding and study validity. The study methodology will continue to outline the methods and protocols put into practice when collecting and analysing data with the results and key findings presented and discussed in relation to existing literature, ultimately highlighting the impact of playground markings on the participant's physical activity levels

and play behaviours. Any study delimitations, limitations and challenges will be highlighted followed by directions and opportunities for further study in the field.

2. Literature Review

There exists a plethora of literature discussing children and young people's (3-18 years of age) levels of engagement in physical activity (Sallis *et al.,* 2000; Hinkley *et al.,* 2008) and the reported negative impact of inactivity and sedentary behaviours on health and development. This wealth of literature in the field of physical activity highlights the relationship between young people being physically active and the associated impact and issues with health and the reported links to physical, social, emotional and cognitive development (Malina, 1996; Bjorklund and Brown, 1998; Pica, 2003; Burdette and Whitaker, 2005; Rink *et al.*, 2010; Brockman *et al.,* 2011). The subsequent chapter aims to shape the rationale for the present study by exploring and critiquing existing literature in this area and pinpointing prior study findings and limitations.

The review will look at the reported importance of engaging in physical activity from the early years of childhood and infusing habitual active behaviours in day to day life and the links between activity, play and learning. Furthermore, literature in relation to the role of the different environments in engaging inactive young people in increased levels of physical activity and active play, with a particular emphasis on the examination of the rising number of studies focusing on activity interventions, ultimately aiming to increase levels of activity and affect health. This review also aims to discuss both the theoretical and methodological approaches of the literature and in turn signify limitations, and subsequent implications and direction for the present study.

2.1 Physical activity and young people

It is widely reported that children are engaging in reduced levels of physical activity as a consequence of being inactive or spending extended amounts of time sedentary (Pica, 2003; Lobstein *et al.,* 2004; Jago *et al*, 2005; Burdette and Whitaker, 2005; Ridgers *et al, 2007;* Brown and Summerbell, 2009; Loprinzi and Cardinal, 2011). Studies within the field of young people's physical activity place strong emphasis on the need to meet activity recommendations and the integral role of PA in sustaining a healthy lifestyle and reducing the risk of obesity and wider health issues.

Health issues linked with inactivity and those heavily reported in studies concerning adults are becoming more evident in childhood (Ebbeling *et al.,* 2002; Torpy, 2010). Multiple causes are documented to contribute to excessive weight. Genetic factors are referred to have an effect on individual predispositions, however the predominant effects reported to have an influence are those that raise energy intake or decrease energy expenditure (Ebbeling *et al.,* 2002). Low levels of energy expenditure through sedentary behaviour and little physical activity combined with excess energy intake via energy rich foods have led to a reported incline in obesity, excess weight gain (Brockman et al., 2011) and wider related health risks amongst children and young people. Heart problems, high blood pressure, sleep apnoea, diabetes, osteoarthritis and mental ill-health problems such as depression and low self-esteem are now reported to be more prominent in the earlier stages of the life course (Ebbeling *et al.,* 2002; Torpy, 2010).

Over the last two decades obesity rates amongst children in the UK have increased dramatically with national statistics (NHS, 2011) reporting that 33.4% of Year 6 children (11-12 years of age) are obese or overweight. Excessive weight gain is reported to being an ever increasing issue and even described as an 'epidemic' (Reilly and Dorosty, 2000: 1) in the UK and a major public health concern. Stellino *et al., (*2010) report that substantial evidence exists identifying a correlation between low levels of physical activity and an increased likelihood of individuals becoming overweight or obese, furthermore, this issue of obesity is suggested by Pate et al., (2004:1258) to be 'increasing among children of all ages'.

A review conducted into the tracking of overweight status from childhood to adulthood by Singh *et al.,* (2008:474) outlines the risk of overweight children becoming overweight adults to be at least twice as high, as review studies consistently reported 'an increased risk of overweight and obese youth becoming overweight adults'. This trend is fundamentally linked with declining levels of PA and sedentary behaviours becoming habitual from childhood and continuing through to adolescence and adulthood (Reilly and Dorostys 2000; Singh *et al.,* 2008; Brockman *et al.,* 2011). This reported relationship between obesity in children at a young age and continuation into adolescence and adulthood and the link to health risks drives the rationale behind tackling inactivity at an early age (Stratton and Mullan, 2005). Currently statistics report that 22.6% of early years children in the UK (3-5 years of age) are obese or overweight. A research review into time engaged in levels of activity states boys and girls respectively spent 54.4 minutes (7.1%) and 45.4 minutes (6.3%) of their day in moderate-vigorous physical activity (Bornstein *et al.,* 2011).

The rise in inactivity and sedentary behaviours amongst young people are widely attributed to developments in modern lifestyles. Social changes (Lindon, 2003) and technological advancements have impacted on young people's activity choices and behaviours. This has resulted in a distinct increase in the amount of time spent in a sedentary state and engaging in activities that use low levels of energy, such as screen-time spent watching television, playing computer games and a lesser need for active travel, such as travelling by car instead of walking or cycling (Lindon, 2003).

In order to combat the development of habitual sedentary behaviours and encourage inactive children to engage in increased levels of activity it is important for children to build a positive attitude towards physical activity from a young age.

> '*Many behaviour patterns that impact on physical activity experiences are established in early childhood*'
>
> (Hands *et al.,* 2006:203)

This statement is supported by Cardon *et al.,* (2009) who assert that physical activity in early childhood is associated with important health benefits. However, even though Singh *et al.,* (2008) conducted a comprehensive systematic review of links between childhood and adulthood obesity, Cardon *et al.,* (2009) state that the links between early year's engagement in PA (physical activity) and continued implications for health require further study to establish and evidence patterns of behaviour and activity and moreover ascertain the activity levels of early years children. There exists a base of literature examining children's physical activity levels (Stratton, 2000; Sallis *et al.,* 2000; Nilsson, 2002; Stratton

and Leonard, 2002; Stratton and Mullan, 2005; Ridgers *et al.,* 2007; Ridgers *et al.,* 2010). Cardon *et al.,* (2009) report that 5 year old children spend 11.2% of their playtime in MVPA and 61.3% in sedentary activity and research by Hannon and Brown (2008) assessing the physical activity levels of 3-5 year old children in the playground state that participants engaged in MVPA for 18% of playtime and spending 49% in a sedentary state. However, the vast majority of the research in this area has primarily focused on the physical activity levels of children over the age of 5 with no study looking at the impact of markings on the Foundation Stage age group. Furthermore, Hinckley *et al.,* (2007) review literature concerning the correlates of 'Preschool Children and Physical Activity', with the findings highlighting research to have limited focus and there being a need for further research to be conducted into the physical activity of young children and what factors influence their behaviours.

It is widely reported that prevention is more effective than treatment (Ebbeling *et al.,* 2002), suggesting that early childhood settings and active environments are important for creating change in health habits and should be targeted as environments for primary prevention measures and interventions (Riethmuller *et al.,* 2009; Ridgers *et al.,* 2006; Almqvist *et al.,* 2006; Pate *et al.,* 2004). Furthermore Children's physical inactivity has been categorized by Stratton and Mullan (2005) as a modifiable risk factor for lifestyle-related diseases, and therefore an issue that can be tackled through the use of interventions and creating an active culture. Study into this area and the factors that influence children's PA is vital, as Ridgers *et al.,* (*2010*) recommends that when designing an intervention, developers should be cognizant of variables that may affect levels of children's PA.

2.2 Physical Activity guidelines

There have been an array of guidelines directing how much PA early years children should engage in. From pre-school aged children recommended to accumulate at least 120min of PA per day in a mixture of structured and unstructured activity in 2002 (Sport and Physical Education, 2002) to suggestions that engaging in 60minutes of moderate to vigorous PA per day is most beneficial (department of health and physical activity, 2004). However the most recent physical activity guidelines outlined by the National Health Service (NHS) and Chief Medical Officers (2011) for young children (classed as children 5 and under with the ability to walk) state that individuals are advised to participate in 180 minutes of physical activity throughout the day. These guidelines take into account that young children's PA is sporadic and intermittent, and advise 180 minutes as a sum for all PA from throughout the day.

The guidelines emphasise that activity of any intensity, light, moderate or vigorous are included and can provide health benefits for young children. The guidelines suggests Light activities are to include standing up; moving around; walking at a slow place and less energetic activity. More energetic activity (moderate-vigorous) involves active play (games such as stuck in the mud/hide and seek); fast walking; dancing; swimming; skipping and gymnastics. However, these guidelines present a lot of grey area, as some children may engage in high levels of vigorous PA throughout the day and others may only engage in light activity and be classed as inactive (British Heart Foundation, 2012). Though both cases will be classed as meeting the recommendations, the children may have participated in very varying levels and types of activity; potentially being problematic for parents/guardians/teachers and researchers to gauge if a child is meeting

recommendations. Furthermore, the intermittent short bursts of activity that are exhibited by children in the early years are particularly hard and impractical to track and measure throughout the day. Therefore it is important that studies take into consideration research designs and methodologies that are constructed to capture accurate information and data on children's physical activity types and activity intensities to establish if recommendations are being met.

2.3 Physical Activity and Play

Physical activity in young children is synonymous with play and in turn linked with health and early year's development. It is highlighted that children need active and energetic play to allow them to develop their fundamental movement skills, master their physical environment and establish healthy lifestyle behaviours that may continue into later life (Oliver *et al.,* 2007). A key theme emerging from literature regarding young children and play is the benefit of active play to growth, development and furthermore, as outlined previously, to have a positive impact on health (Stellino *et al.,* 2004; Ridgers *et al.,* 2006; Oliver *et al.,* 2007). Play is the main context in which young children are active, subsequently encouraging active play at this age (3-5 years) is becoming more prevalent, aiming to increase levels of PA and active behaviours. As the importance of young children's play is recognised as a platform to increase activity, Interventions seeking to encourage young children to engage in active play have come to the forefront and increased over the last few years.

Not all play amongst children is physically active. However, Ward *et al.,* (2007: 11) state that 'play and physical activity are, usually, intermittently linked'. This link is particularly synonymous with young children who commonly demonstrate short periods of gross motor play (Burdette and Whitaker, 2005). Children may choose to create, repeat or imitate games or role-play which incorporate already established or impulsive aims or rules. Therefore when defining play in relation to child age it is also of common note that as children become older their play becomes more formal, structured and less free in nature (Lindon, 2001). This in turn supports the assertion that play amongst young children (3-5 years of age), is more episodic and spontaneous (Lindon, 2001; Burdette and Whitaker, 2005; Ward *et al.*, 2007).

Young children frequently change activities and interests in relation to the environment surrounding them and typically exhibit short bursts of vigorous activity that are followed by less-intense recovery periods (Hinkley *et al.*, 2008). These characteristic short periods of vigorous physical activity (VPA) occur alongside varying levels of less intense activity: moderate vigorous physical activity (MVPA); moderate physical activity (MPA); light physical activity (LPA) and sedentary behaviours (SED). These levels of activity are governed by a child's own choices and motivated by their thoughts, feelings and imagination, in relation to the physical and social environment that surrounds them (Lindon, 2001). However this leads to question if inactive children can be influenced to be more active by their surrounding environment and what interventions are effective.

To understand the value of active play and the impact on a young child's physical, social and cognitive development it is firstly important to define what the term 'play' means. Literature

depicts play to be a multifaceted construct (Lindon, 2001) that can cover various aspects of children's play across different age groups, play behaviours and types of play activity including social play; sensorimotor play; language play; fantasy play; active/exercise play and object play (Smith, 2010). When further exploring the wealth of literature (Lindon, 2001; Smith, 2010; Burdette and Whitaker, 2005; Ward *et al.,* 2007) to focus on the play of young children researchers largely concur in their ideas and theories on types of play, drivers of play, the context of play, the nature of play and what it means to partake in playful activities.

The types of play as outlined by Smith (2010) are broadly defined to be unprompted activities that children engage in to amuse and occupy themselves (Burdette and Whitaker, 2005; Ward *et al.*, 2007). Literature continues to describes play to be a free activity that is partaken in purely for the sake of amusement and enjoyment (Smith, 2010), with no pre-determined goal or structure. Manwaring and Taylor (2010) support Smith's ideas in stating that play is generally a freely chosen, personally directed and intrinsically motivated activity, with one of the primary motivations being intrinsic satisfaction. However in conflict to these ideas of play being a purely free activity literature also suggests (Lindon, 2001) that play can be organised in nature, in particular amongst older children.

Play being more of a free activity and evolving to become more structured with age is reiterated throughout Piaget's theory of play behaviour (Lindon, 2001). Piaget's theory dictates that in the early years of development children primarily engage in symbolic play. This theory of symbolic play (Lindon, 2001) suggests that between the ages of 2 and 6 years children exhibit their ideas about the world around them by incorporating them into their

play, ultimately symbolising what they know and learn through the avenue of free-play. Subsequently, Piaget proposes that from the age of 7 years and upwards children are able to grasp more abstract ideas and therefore include rules and structure to their play as well as share common understanding with other children. This is echoed by Tannock (2011) who states that children move into more complex behaviours as they mature. These theory's of play behaviour need to be considered in the study research design, methodology and methods of data collection when focusing on a particular age group, in this case 3-5 year olds, in order to capture data on free play activity. In addition, Vygotskys theory of 'Zone of proximal development' (Lindon, 2001) denotes that to effectively learn and develop as an individual, a child needs some aspects of guidance from adults or peers in order to gain the maximum benefits from free-play learning.

Brockman *et al.,* (2011) state that active play is an unstructured physical activity which takes place outdoors in a child's free time. This is a narrow understanding of play and physical activity as it is evident that active play can take place in a multitude of settings (indoor or outdoor) and can take a variety of structures, aims, rules and roles. Smith (2010). Play includes a range of activities, undertaken in relation to individuals' interests and satisfaction.

Young children spend large periods of their free time in play. Literature suggests that play and play behaviours have the potential to improve all aspects of children's well-being and development; this being physical, emotional, social and cognitive (Rink *et al.*, 2010; Burdette and Whitaker, 2005; Malina, 1996). Play is considered critical to children's development, with movement reported to be an essential part of early year's growth (Pica, 2003).

Literature in this area of study largely upholds that play and active play not only contribute to the time children spend physically active, and the consequent benefits to physical health, but simultaneously has a positive and significant influence on the holistic development of children from a young age. Lindon (2001) suggests that play can include a wide range of activities that contribute to learning new skills, intellectual stimulation and building social relationships. Therefore as the time children spend in PA free play is seen to be decreasing it is essential to recognise the links active play has with health and development, what can be learnt from previous literature in this field in relation to young children, implementation and evaluation of previous interventions and studies and the development future interventions and research.

Potential factors that are reported to constrain or facilitate young children's PA and play are multidimensional (Brockman *et al.,* 2011; Hinckley *et al.,* 2007), from the environment to child characteristics or social interactions. Factors documented also include sex, age, prompts received (adults or peers), seasons, equipment provision, playground space, playtime duration and encouragement from supervisors (Brustrad *et al.,* 1999; Trost *et al.,* 2002a; Cardon *et al.,* 2009; Ridgers *et al.,* 2010; Janssen *et al.,* 2011; Brockman *et al.,* 2011). Consequently, the present study needs to consider the impact that these multiple factors may have in order to provide clear picture of children's physical activity (Ridgers *et al.,* 2006) in relation to the study aims and in the research design and methods utilised.

Studies looking into children's physical activity have reported gender differentiation, results for differences in PA levels and social interactions generally convey that boys engage in more

MVPA, VPA, competitive games, active-forceful play, play further form adults, stereotyped play activities, bigger groups and more same-sex play than girls (Sallis *et al.,* 2000; Trost *et al.,* 2002a; Fabes *et al.,* 2003; Pate *et al.,* 2004; Ridgers *et al.,* 2006; Hinkley *et al.,* 2008; Cardon *et al.,* 2009; Stellino *et al.,* 2009). Furthermore this behaviour is reported to be exaggerated in groups and, generally, children rarely play with children of the other sex (Fabes *et al.,* 2003). Research conducted by Cardon *et al.,* (2008) also showed that more available space within a play environment is associated with higher activity levels in young children, particularly amongst boys'. With research stating that girls view play time as an opportunity to socialise with friends and preferring to engage in less vigorous activities than boys (Ridgers *et al.,* 2006; Boulton, 1999).

Wood and Cook (2009) discuss post-structural feminist theory in relation to gendered play of 3-5 year old children within the playground, with play reported as a means through which boys and girls construct gender identities through social affiliations and play activities. Wood and Cook (2009) highlight how these gender roles of boys engaging in more boisterous and rough and tumble activity and girls more quiet, repetitive domestic play themes, exercising masculine and feminine powers respectively, are inadvertently encouraged by adults not challenging stereotypical gender behaviours or contesting children's free-play choices. In relation to child physical activity this leads to question that if boys and girls are socialised into playing in the highlighted gendered activity types are boys being encouraged to be more active on the playground from a young age or are boys and girls both active in their play pursuits away from the gaze of adults. Furthermore, are these gendered identities perceived

and imposed by adults through not challenging certain behaviours as viewed as the norm for children's play.

However, there are studies that show converse results to this, were girls participated in more MVPA than boys (Santos *et al.,* 2003; Mota *et al.,* 2000), therefore presenting a grey area on the influence of child gender and their engagement in different levels of physical activity, and a call for research to cast light on whether gender is a predictor of activity levels and also to further evidence if girls are more inactive than boys and if there is a need to develop targeted interventions to increase female activity or non-gendered interventions aiming to get boys and girls more active.

The impact of the seasons is considered a potential influencing factor on children's PA levels and play dynamics when in an outdoor environment (Irwin *et al.,* 2005). Focus groups conducted by Brockman *et al.,* (2011) states 10-11 year old children reported adverse weather to be a constraining factor when discussing their motivations to engage in active play in and out of the school environment. However, research conducted on activity within the playground environment by Ridgers *et al.,* (2006) reports that objective measures of heart rate telemetry and accelerometers showed no significant variation to children's playtime PA levels across days and seasons (participants 7-8 years of age). Interestingly Ridgers *et al.,* (2006) also discuss the recorded variability of weather on girls who were found to be more active during winter months in comparison to boy's activity being consistent over different seasons. This highlights the potential impact of weather on participants subject to their gender. A study conducted by Rowland *et al.,* (2009)

investigating the seasonal changes in PA of 9-11 year old children found that bouts of activity during play time at school were variable, however findings reflect those of Ridgers *et al.,* (2006) in that physical activity patterns were consistent amongst participants irrespective of the reported weather conditions. Despite seasonal implications being reported as minimal on physical activity levels the weather may impact the type of activities children engage in. However, these reviewed studies focussed on older participants (≥7 years of age) than the present study and therefore the researcher needs to be aware of the possible affect of weather on participant activity when conducting field research. To increase study validity and evade any affect on physical activity research assessing children's PA and play dynamics in an outdoor setting should be conducted during the same season to maximise chances of consistent weather conditions.

A study conducted by Pate *et al.,* (2004) reports that the school attended by a child is a significant predictor as to the levels of physical activity. Therefore individual school ethos towards physical activity and associated policies and practices (Brown *et al.,* 2009) that are often variable amongst schools, may have a direct or in-direct influence on PA levels on the school playground. This may be linked with demographic and socio-economic factors. Therefore factors such geographical location, playground size, school size and population may need to be taken into consideration when designing study methodologies and selecting schools for study inclusion.

Even though the present studies focus is to assess the impact of a playground intervention on play and the PA and play behaviours of children in their early years it is essential to

recognise that the roots of this research are essentially linked to the issue of health and the need to increase levels of physical activity amongst inactive children.

2.4 Play and Child Development

The view that the best means to develop a Child's cognitive abilities is through engagement in intellectual and structured activities is being challenged (Bundy *et al.,* 2009). Free play outdoors is often limited due to a perceived physical risk by adults and overshadowed by the presumed benefit of structured academic activities (Bundy *et al.,* 2009). However, in recent years the greater benefit to children engaging in real play and age appropriate risk taking to their learning and development is being recognised. Research is increasingly stating a positive link between outdoor free play, physical activity and children's learning development and social interactions (Bundy *et al.,* 2009; Burdette and Whitaker, 2005). For example, Burdette and Whitaker's (2005) study into the wider benefits of active free play discuss that negative effects of restricted plays environments (lack of stimulus, too many rules and limited freedom) and state that within this setting children are more likely to bully and exert undesirable behaviours. This suggests that opportunities for children to play outdoors, such as in school playgrounds, should not be limited but encouraged and furthermore the environment should provide multiple opportunities for children to engage in free-play supported by interactive stimulus such as equipment, play structures or playground markings.

Zastrow and Kirst-Ashman (2010) convey that play provides a context in which children learn how to interact with other individuals and socialise, whilst exerting physical and mental skills. Play also allows a child to gain understanding of their physical environment, develop proprioception in knowledge of individual body orientation and movement. When considering the cognitive and sociological concepts of play in relation to early year's development, play can be a platform for children to explore and exert their individual creativity, have positive and negative interactions with peers and learn social constructs such as to compete and share. This avenue for socialization (Zastrow and Kirst-Ashman, 2010) is described by Rink et al., (2010) to advance children's learning of accepted norms of their cultures social behaviour:

> *'Children who do not learn to participate in the accepted forms of play of their culture are at a disadvantage socially'*
>
> (Rink *et al.*, 2010: 6)

Therefore active play can be utilised to aid children in developing an understanding of the world around them and learn how to interact with other individuals as to adhere to and learn societal and cultural norms.

When discussing play behaviour it is important to consider children's social interactions. Gubbles *et al.,* (2011) hypothesise that multiple factors within a play environment can influence social behaviour. Alongside the impact that the physical environment can have on physical activity (play area, equipment), the social environment (child group size, adult group size, positive and negative peer interactions, prompts) and child characteristics (age, gender)

have independent and interactive effects on children's activity (Gubbles *et al.,* 2011). This ecological perspective on factors that influence children's activities and play behaviours (Gubbles *et al.,* 2011) therefore must be considered when conducting research into children's PA levels in a physical and social play environment.

Gubbles *et al.,* (2011) suggest that changing the physical and social characteristics of a young child's play environment may enhance PA intensity amongst young children. However, this leads to question whether changing the physical environment, such as the introduction of equipment or painted playground markings can impact the social behaviours and interactions of young children and potentially encourage social interactions as well as engage inactive children in PA.

This idea that play supports cognitive development is supported by Bjorklund and Brown's study 'Physical Play and Cognitive Development: Integrating Activity, Cognition, and Education' (1998). They state that play is important to shaping social cognition, as well as cooperative and social play leading to the development of moral reasoning and a child's ability to make judgements. The impact of play on cognitive development in young children is stated by Lindon (2001) to be significant; as children begin to understand ideas and learn to think at an early age through the dynamics of play. Play therefore embodies vital life skills (Bundy *et al.,* 2009) such as 'communication' (sharing, establishing rules, turn-taking, negotiation, leadership) and 'social interaction' (playing within a group, deciding who to play with, forming friendships, conflict, empathy, awareness). Play supports a child's emotional development, as it is a prominent context during the early years where children socialise,

express themselves, are free to take their own actions and shape awareness of their environment.

Bundy *et al.,* (2009) state a positive link between school achievement, performance on cognitive tasks and involvement in play at school playtimes. This link is stated to be even more prominent in children who frequently interact with their peers.

> *'...if children do not engage in high-quality play, their capacities in areas such as metacognition, problem- solving, social cognition, literacy, mathematics, and science, are likely to be diminished'*
>
> (Bundy *et al.,* 2009)

This hypothesis that outdoor free play can contribute to the holistic cognitive skill development of children shows the need for playgrounds to be utilised to their maximum potential and children to be given the opportunity to freely interact and engage in play activities with their peers.

Yelland's study into reconceptualising play and the ways in which young children gain knowledge of their environment (2011) discusses that play is used as a mechanism for 'young children to interact with the world and learn' (2011: 4). Play is recognised as an essential component of early childhood experiences. Yellend argues that, when supported by pedagogical practices play can be utilised as a tool to support children's learning and cognitive development. This poses to question whether the development of education based play interventions, for example play based games, equipment or playground markings

that depict numbers, shapes and curriculum themes are aimed to instigate creative thoughts and the implementation of such interventions can increase opportunities for children to engage in self-initiated play. (Ridgers *et al.,* 2007; 2010; Bundy *et al.,* 2009; 2011; Cardon *et al.,* 2009; Stellino *et al.,* 2010; Blaes *et al.,* 2013). Play activities can then build on individual ideas, concepts and skills as well as encouraging young children to make free-play choices. Even though evidence dictates that learning and play are interlinked, and learning consequently occurs 'spontaneously' (Yellend, 2011: 5) throughout play, Yellend (2011) highlights the importance to recognise the context in which this learning is occurring, and how cognitive engagement can be promoted. It is widely acknowledged that young children will engage in free-play absent of tactile and tangible play equipment and guidance. However, it is hypothesised that given the opportunity to interact with their play environment, and given creative stimuli such as playground markings made up of various colours, patterns and shapes can support and prompt active play and in turn enhance the learning process amongst young children.

Free play is a context in which children are likely to encounter opportunities for decision making that stimulate problem solving and creative thinking (Burdette and Whitaker, 2006). This is particularly evident in outdoor spaces that allow few constraints on gross motor movement and provide a more varied and less structured setting (Burdette and Whitaker, 2006). Thus allowing children to utilise their imagination and make choices in a free play setting. This is shown to also have an impact on emotional development and may ultimately impact children's happiness.

'...free play has the potential to improve many aspects of emotional wellbeing such as minimizing anxiety, depression, aggression, and sleep problems'

(Burdette and Whitaker, 2006:48)

Meaning play may have a cathartic impact, allowing children to express themselves in a free environment.

Research conducted into children's playground behaviours and social preferences establish school playtime as an 'especially important context' (Boulton, 1999: 944) for the development and maintenance of children's peer relationships. Free play within a naturalistic play setting is also seen to impact children's interactions with peers (Boulton, 1999) as children who are seen to spend a majority of time alone on the school playground are depicted to be more inclined to negative social interactions and subjected to bullying behaviour from their peers.

Peer relationships and interactions are reported to have an impact on children's PA levels, as children are often prompted to play by peers and engage in physically active group games (Boulton, 1999). Furthermore, Boulton's (1999) study into play and children's peer relationships shows that children who participate in higher levels of cooperative play are more widely socially accepted by their peers; showing a positive relationship between social interaction and activity. However, this research focussed on older children (8-9 years of age) with no studies having evaluated the relationship between young children's social interactions, group size and physical activity within the environment of the school

playground. Consequently there exists a need for research into this area and evaluate any link to play interventions and effect on social behaviours and activity. As previously described young children naturally exhibit physically active play behaviours and to question to what extent social interactions impact activity levels, whether increased positive interactions with peers may increase levels of PA and whether playground markings are effective in encouraging social and active play.

Free-play amongst young children offers a unique opportunity for individuals to engage in and begin to understand social behaviours amongst their peers. Children's social interactions, experiences of physically active play and cognitive engagement in play activities are essential to establish physical and social behaviours from an early age. Playing is an opportune context in which foundations for learning social constructs and stimulating cognitive development can be facilitated. With experiences in childhood aiding to develop social and cognitive abilities that are utilised throughout life. Yelland (2011) states that play is synonymous with learning in the childhood years and is characteristically viewed as the mechanism by which all young children interact with their worlds, develop conceptual understanding and ultimately learn.

2.5 Interventions

Existing studies for activity interventions are limited as they tend to focus on increasing PA levels in older children linked with the theory that the end of primary school (10-11 years) is 'a critical period of change' (Brockman et al., 2011:1) amongst this age group, for example moving on from primary to secondary school. As previously outlined there is an increasing shift in focus on interventions and research targeting younger age groups following studies highlighted health issues to be impacting younger generation's (Ebbeling *et al.,* 2002; Torpy, 2010). Developing continuous opportunities for children to be active in a safe, enjoyable and interactive environment starting from the early years and throughout childhood is paramount in tackling linked to inactivity and getting young children more active.

Public health initiatives and interventions are utilised as preventative measures as opposed to treatment, as they often prove more cost effective and valuable in outlining and guiding healthy lifestyle choices within the public domain; aiming to reduce the onset of public health issues (Ebbeling *et al.,* 2002). Preventative strategies through the use of public interventions are becoming more prominent when considering children's PA levels. Initiatives aimed at the early years of life to increase opportunities to partake in enjoyable physical activity assist in 'establishing patterns of behaviour that may persist into later childhood and adulthood' (Almqvist et al, 2006). As previously stated inactive behaviours and overweight status during childhood tend to continue into adulthood and the importance of developing healthy cues from a young age (Pate *et al.,* 2004; Burdette and Whitaker, 2005; Heaton-Harris, 2009; Stellino *et al.,* 2010).

The school playground is a key opportunity to modify PA and encourage inactive children to engage in higher levels of activity. Furthermore, research has shown there may be an association between frequency of play at school and higher frequencies and intensities of PA after school (Brockman *et al.,* 2011). However, the review conducted by Brockman *et al.,* (2011) has states a need for further research to be conducted in the area of early years PA, PA interventions and the factors that may influence young children's PA levels.

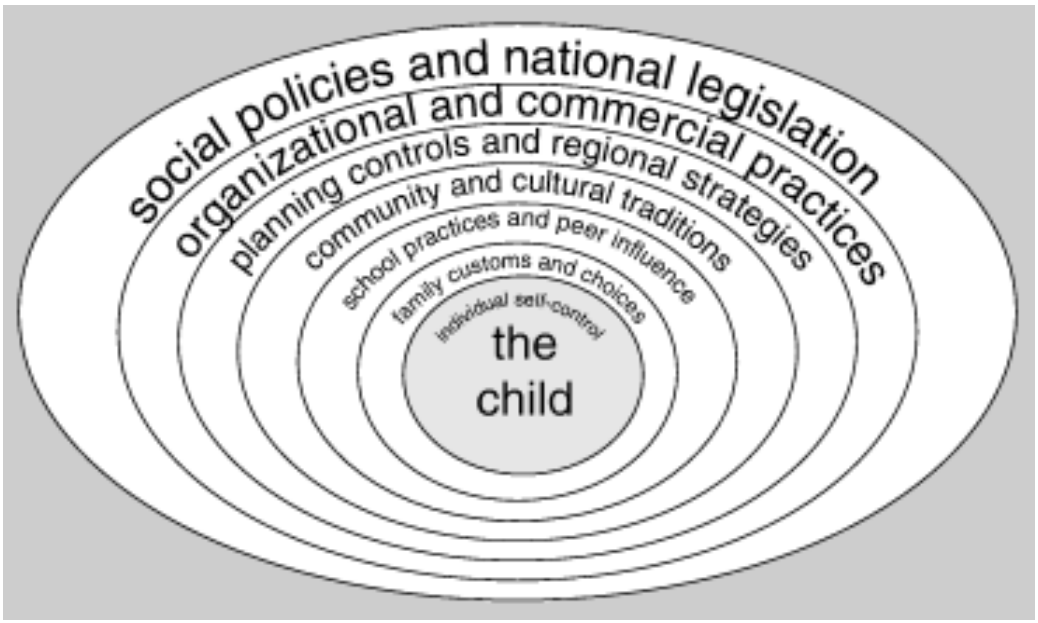


Figure 1: Opportunities for influencing a child's environment (Lobstein *et al.,* 2004)

Literature highlights that the play environment is an important opportunity to trigger PA (Cardon et al., 2009). The school playground is reported as a key environment to engage a large proportion of children in active play during play time (Huberty *et al.,* 2010). Figure 2 (Lobstein *et al.,* 2004) presents the school environment and peer influence as a step on their multi-level model for opportunities to influence a child's environment and promote engagement in PA. It is important to take into account that these levels are interlinked both inwards and outwards. For example a child might be inactive in their home or family environment and have limited opportunities for physical activity and therefore this may be

reflected in their activity levels at school. Also community or cultural traditions may focus on academic and not recreational or play activities and therefore impact on levels of physical activity. However, this is also the case for the influence of the school environment and the playground as an ideal setting for an intervention to have mass impact, as multiple children are in the same play environment at the same time with limited influence and an opportunity, away from the home environment, to engage children in active play, which as highlighted by Brockman *et al.,* (2011) may influence their activity outside of the school gates.

A study conducted by Cardon *et al.,* (2009) reports that children spent as little as 11% of their time in activity within the school playground, highlighting the potential for playtime to increase time spent in PA. However, it is important to underline that interventions need to be evidence based in order to be effective; therefore it is critical to understand the target age group in relation to the intervention. Cardon *et al.,* (2009) report that simply changing a play environment may not be sufficient to promote physical activity in young children. However, contrary to this, Ridgers *et al.,* (2007) state that a sterile play environment may not be adequate to stimulate creative or active free-play, as existing playground research conducted by Crust *et al.,* (2014) reported a 7.5% increase in observed physical activity in 10-11 years and Ridgers *et al.,* (2007) 4% increase in MVPA amongst 7-8 year olds, post interventions to re-design the school playground (markings and physical structures) as a stimulus for play (Table 1).

> *'...environmental interventions such as playground markings, obstacle courses and equipment provision to increase activity on the premise that exposure to supportive*

physical environments can facilitate physically activity behaviours. Short-term increases in physical activity levels have been reported'

(Ridgers *et al.,* 2007:393)

This statement is supported by Stratton (2000) who reports that, as well as stimulating physical activity, playgrounds in turn have the potential to promote children's health. However, Cardon *et al.,* (2009) highlight that environmental interventions have been reported to have 'short-term' effects; therefore further study is needed to determine the long-term impact of such initiatives.

As Ridgers (2006: 360) reports that 'opportunities for children to engage in daily physical activity are dependent on a number of socio-economic, environmental and personal factors', this suggests that data collection methods need to take into consideration these wider contexts of the school playground as well as direct measurement of PA levels to paint a clearer picture of child activity and the development of interventions. Playground interventions are developed to stimulate and encourage children's creativity and imagination as well as their play behaviours, social interactions and choice of play activity. This idea of play supported cognitive development suggests ideas that active free-play within an interactive and dynamic outdoor play environment that appeals to young children's curious, creative and spontaneous nature could increase the potential to stimulate play based development and PA levels. Research suggests that a playground design, which utilises multicolour painted playground markings, is a suitable stimulus for increasing children's school playtime physical activity levels (Stratton, 2000; Stratton and Leonard, 2002; Stratton and Mullan 2005; Ridgers *et al.,* 2010; Crust *et al.,* 2013; Blaes *et al., 2013*).

'Even the most imaginative child will find it difficult to be creative and sociable in a bleak, sterile space for a quarter of every school day. At best, such spaces are breeding grounds for boredom and unhappiness. At worst they may actually cause hostility, bullying and an ethos of 'survival of the fittest'

(Titman and McGill, 1992)

Research conducted by Blaes *et al.,* (2013) reports playground markings to have a significant impact ($p<0.05$) on activity levels of 6-11 year olds, as post the installation of markings children spent more time in moderate and vigorous activity and significantly decreased time being sedentary ($p < 0.05$) in comparison to baseline measurements, however this study is limited to only reporting the short term effects. These short term findings are also supported in their reported effect by Ridgers *et al.,* (2007) who reports that changing the playground environment through the installation of painted playground markings produced the strongest effect on the youngest children in the sample (children 7 years of age). However, no studies evaluating this positive association between the installation of playground markings and PA have focussed on the impact on foundation stage children (3-5 years of age). As previously outlined, early year's child play behaviours are reported to be naturally linked with physical activity. This poses to question whether playground markings can have a positive impact on the dynamics of foundation stage children's physically activity and play at playtime and support justification for the present study. The playground presents an opportunity where play and participation in PA may not be limited by factors such as sedentary engagement with technology, lack of opportunity, neighbourhood safety concerns and socio-economic status; all of which are elements that are stated to effect children's engagement in physical activity (Sallis et al, 2000). School playtime is also stated to have an

advantage over Physical Education lessons as all children have the opportunity to take part daily physical activity (Stratton, 2000).

Outdoor settings are also reported to be an environment where children to most likely engage in free play and gross motor activity (Burdette and Whitaker, 2006). The school playground is increasingly being recognised as an outdoor free-play setting where the environment may be modified and interventions put into place to increase physical activity levels. Children are reported to play outdoors 'less frequently than previous generations' (Brockman *et al.,* 2011:2). This is an issue as outdoor environments are highlighted to provide a plethora of opportunity for active and social free play. Furthermore, adopting sedentary lifestyle are reported to be apparent once children reach the age of 3-4 years (Reilly and Dorosty, 2000); highlighting the early years as a significant period to instil active behaviours as the norm.

Ridgers *et al.,* (2006) state that despite playtime being popular with pupils and accounting for a significant amount of school time, it is considered the forgotten part of the school day, with the main focus being placed on Physical Education lessons. However, with growing concern that curricular time allocated to Physical Education is not meeting statutory guidelines (Ridgers *et al.,* 2006) these attitudes are changing and more focus is being placed on promoting PA at play time. For example, Foundation Stage children typically receive 1 hour of allocated PE a week, however spend around 1 hour on the playground each day, made up of AM, midday and PM playtimes. Play time is being recognised as an essential

opportunity to engage children in active, creative and diverse outdoor free play that can support physical activity lessons in engaging young children in physical activity.

2.6 Measuring interventions

Multiple playground interventions have been developed to promote the PA of children at school playtime including the presence of equipment, encouraging verbal prompts from supervisors (Gubbles *et al.,* 2001; McKenzie *et al.,* 2010; Bundy *et al.,* 2009), installing play facilities (Nielson *et al,* 2012), playground markings (Stratton, 2000; Stratton and Mullan 2005; Ridgers *et al,* 2007; Crust *et al.,* 2013; Blaes *et al.,* 2013. However methods utilised to measure playground context and children's PA have exclusively utilised quantitative (accelerometers; pedometers; HR telemetry) or qualitative (observation; interviews; focus groups) data collection methods (Review by Hinckley *et al.,* 2004) and are therefore limited in their approach to either report on objective findings or subjective findings.

There are a number of established techniques for the assessment of physical activity, which can be grouped into five general categories: behavioural, observation, questionnaires (including diaries, recall questionnaires and interviews), physiological markers (i.e. heart rate monitors), calorimetry and motion sensors (such as accelerometers) (Westerterp, 1999), and all have strengths and weaknesses in their implementation.

Hands *et al.,* (2006) argue the case for pedometers being the most appropriate method of gaining objective measures of physically activity in comparison to accelerometers. Hands *et*

al., (2006) further state the need for valid, reliable and feasible measures to be constructed to identify children who are not developing appropriate and healthy activity habits. Hands *et al.,* (2006) compares pedometry, accelerometry and direct observation methods. Pedometers are a more accurate measure when combined with direct observations for 5-6 year old children. However pedometers are limited to solely collecting a participant's step-count, whereas accelerometers can relay the PA intensity of the participant. Study conducted by Oliver *et al.,* (2009) reports that 75% of 3-4 year olds free play time was spent in one intensity level for <5 sec, with the maximum amount of time spent participating in an activity prior to changing activity intensity being 98 seconds; showing accelerometers to be more relevant when recording objective PA level measurements of young children. Oliver *et al.,* (2009) report that utilising accelerometers on the shortest possible epoch (time between recording data samples) replicates the movement patterns of young children and allows for the sporadic nature of their activity to be recorded.

This recommendation for using pedometers to measure physical activity (Hands *et al.,* 2006) is also converse to perceptions that report accelerometers to be an optimum measurement tool for early year's children. Accelerometers collect objective measures of physical activity (Sherar *et al.,* 2011: 485), providing an accurate and precise measurement of intensity levels and dynamics of physical activity (Trost *et al.,* 2005). Furthermore accelerometer epoch lengths (recording intervals) can be set to reflect the activity of the participants (Nilsson *et al.,* 2002). This reflects the sporadic nature of children's activity as studies conducted by Oliver *et al.,* (2009) while Hands *et al.,* (2006) state that shorter epoch lengths should be applied when recording the physical activity levels of young children to capture the most

valid findings as children often play with short bursts of activity. In addition to setting appropriate epoch lengths, it is paramount that accurate accelerometer cut points are utilised (Sirard *et al.,* 2006; Cardon *et al.,* 2009) and noted that the use of appropriate cut points are essential to accurately assess time spent in various PA intensities, with more research needed in this area to establish participant specific criteria.

A study conducted by Brown *et al.,* (2009) into the physical activity levels of preschool aged children (children aged 3-5) utilised direct observation methods to ascertain the impact of social and environmental contexts on the MVPA and levels of sedentary behaviour. Despite the benefits of utilising observation methods to gain a contextual insight, this approach was limited through the use of a solitary and subjective data collection method. There exist multiple direct observation tools that including OSRAC-P (Observational System for Recording Physical Activity in Children-Preschool Version), SOCARP (System for Observing Children's Activity and Relationships during Play and SOPLAY (System for Observing Play and Leisure Activity in Youth) (McKenzie *et al.,* 2000; Brown *et al.,* 2006; Ridgers *et al.,* 2008*).* These observation methods are diverse in the criteria they record and aim to obtain detailed contextual information (Oliver *et al.,* 2007) on the overall environments surrounding the participants and correlations to their activity levels. Direct observation tools are highlighted as a reliable measure of contextual environment and child activity and behaviours (Ridgers *et al.,* 2007). There currently exist studies that have utilised observation tools to measure young children's activity (Ridgers *et al.,* 2007) within their environment but no studies that have measured the impact of playground markings in participants play dynamics via observational methods.

The use of quantifiable data collection methods such as the objective use of accelerometry to measure physical activity may further support and validate observation results if both methods are utilised in tandem. Accelerometer data reporting levels of physical activity supported by contextual information on the participants' environment captured by observation data allows for data to be correlated and any correlations between of observation data, such as group size or social interactions, on activity levels.

Measuring physical activity levels in young children offers unique challenges as their movement patterns are highly variable, non-structural, and generally comprise of immature, sporadic and short movement patterns and frequent intermittent bursts of moderate to vigorous activity (Hands *et al.,* 2006).

> *'It is challenging to measure physical activity in young people, and all available measures have substantial error and known limitations'*
>
> (Sallis *et al.,* 2000)

Furthermore, qualitative methods of investigation also pose challenges when working with young children. Focus group and interview methods may not be suitable to utilise with young children as the study participants may not have the ability to recall and describe their play behaviours and activities accurately and may copy their peers in group discussion. However, information obtained by proxy from parents or teachers (Hands *et al.,* 2006) are reported as a feasible means of obtaining qualitative perspectives on children's play dynamics and further contextual information on play environments.

Previous studies looking into the impact of playground markings on children's physical activity levels have utilised different methods discussed their potential limitations. Ridgers *et al.,* (2007) noted a limitation in the difficulties in combining quantitative measures of accelerometer data and heart rate telemetry. Limitations in heart rate telemetry are further reported by Stratton (2000) and Stratton and Mullan (2005) who state issues in data validity including the tool being dependent on the emotional state of the child and also individual levels of fitness which are out of the researchers control but may impact on findings.

When considering data collection methods with young children, a multiple method approach and research design in relation to the present study can increase the validity of findings; as Oliver *et al.,* (2007) suggest that combining measurement tools of objective activity monitoring with direct observations may provide the best standard for the assessing the physical activity levels of children.

> *'...factors other than playground markings may also influence children's physically active play.'*
>
> Stratton (2000: 1538)

Furthermore, the utilisation of multiple methods allow for different data, views and assumptions to be explored (Cresswell, 2003:12) and a whole picture of the play environment painted.

3. Methodology

To address the shortfalls in existing literature by Health Promotion Wales (1997), Stratton (2000), Stratton and Mullan (2005), Ridgers *et al.,* (2006; 2007; 2010), Cardon *et al.,* (2009) and Blaes *et al.,* (2013), the current study utilised a multi-method approach to measure the effect of markings on the physical activity levels and play dynamics of foundation stage children (3-5 years of age) in the school playground.

A comparison of two schools with multi-skill zones (painted playground markings, for example see appendix 1) to two schools with no markings is made using a triple multi-methods design, Actigraph Accelerometers (GT3X+ Tri-Axis Actigraphy Activity Monitor), SOCARP (System for Observing Children's Activity and Relationships during Play) and semi-structured interviews with teachers/teaching assistants and playground supervisors (n=8). The markings installed into the playgrounds of the schools within this study are specially designed multi-coloured painted markings called multi-skill zones; (See appendix 1). The two schools with the multi-skill zones had varying painted markings including snakes, mini-courts, hop-scotch, square grids, circle targets, fast feet, line steps, spot steps; all markings were of varying colours and size and were placed at various points around the tarmac surface of the playground. The markings were installed as part of a county-wide initiative by the Center for British Teachers and key partners, with an aim to promote health and wellbeing within the school, through increasing the levels of the participants' physical activity on the school playground. The subsequent chapter aims to outline the study research design and philosophical underpinnings and procedures and protocols for the methods of data collection and analysis.

3.1 Research Design

A multi method design was employed for the study to maximise use of qualitative (semi-structured interviews) and quantitative (Accelerometry and Observations) research methods simultaneously to form three essential components of the single research programme. Results from each method being triangulated to form a comprehensive whole picture (Morse, 2003), enrich findings and increase study validity.

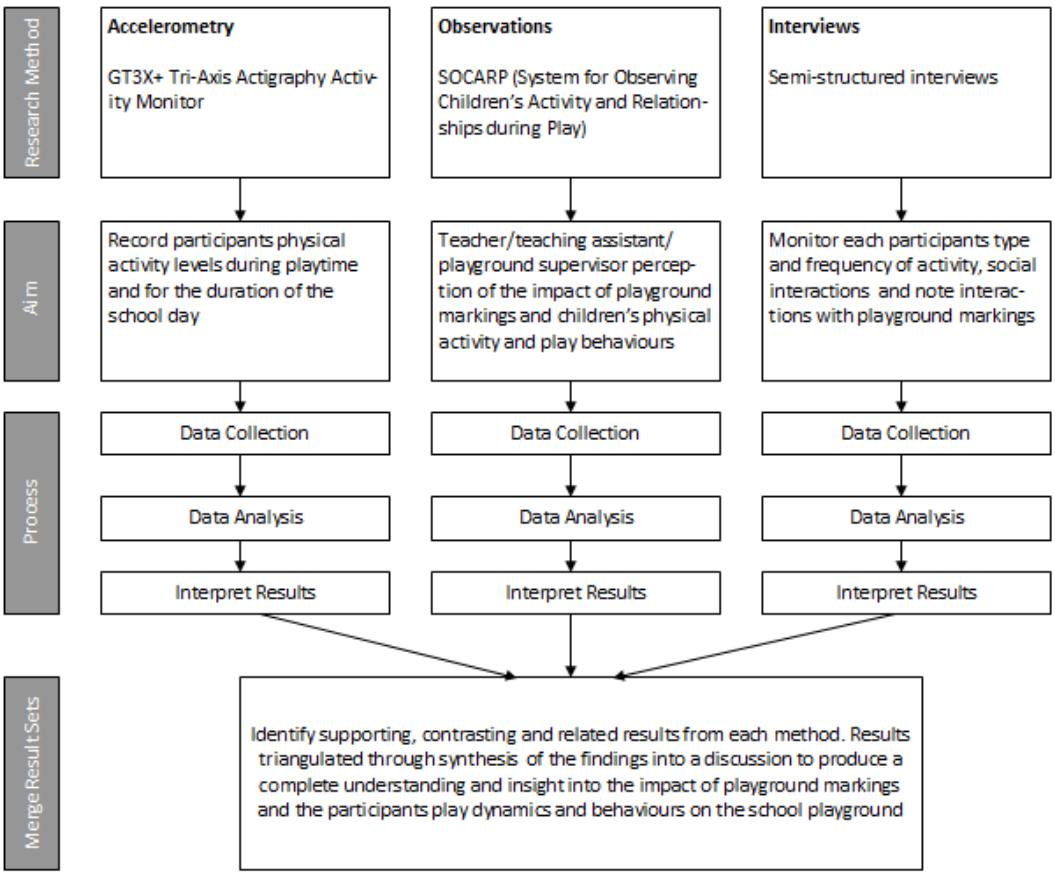


Figure 2: Multiple-method three strand research design

A multiple-method strategy is utilised to limit the bias of solitary methods, further inform the parallel research (i.e. interview data providing wider contextual understanding behind accelerometer results) and add depth and breadth to findings (Cresswell and Plano Clark, 2011). The three methods utilised are brought together in a convergent research design, allowing for extensive con-current data collection (Creswell, 2003) within the same time period. In this instance equal weighting is given to the three parallel research strands (Morse, 2003), with each method aiming to measure the impact of painted markings on the

participants' activity as well as provide insight into different dimensions of children's activity and behaviours on the playground (see Figure 2). Each method is independent from one another in the collection and analysis phases with each completed in a simultaneous data collection period (data collection protocol outlined in Figure 4). A challenge surrounding the multi-method approach is the difficulty of merging data from several different types of data sets (Cresswell, 2003). To maintain the integrity of the data collected from each method the results will be synthesised and compared at the discussion phase of the study, with supporting, contrasting and related concepts triangulated to highlight key findings and build understanding and insight into the impact of playground markings on Foundation Stage children's PA and play behaviours within the school playground.

This study adopts a pragmatic approach to the research that does not reflect one specific paradigm or underlying philosophical framework, reflecting the framework for the research design (outlined in figure 2) but allowing flexibility in the research methodology and methods utilised (Creswell, 2003). This position is adopted to allow the multiple method research design to focus on the study aims and be inductive in providing insight into participants' behaviours and physical activity (Mackenzie and Knipe, 2006). Moreover, no loyalty is given to one paradigm as the multiple methods employed embody aspects of different theoretical approaches such as post-positivism (accelerometers and observations), constructivist and critical theory (interviews) and all possess individual limitations. The pragmatic umbrella allows for the research to be inductive in approach to develop knowledge on the impact of markings as an intervention, question what is already known of

the dynamics of children's play and generate knowledge on how active children are within the school playground.

This research strategy is built upon the underpinning assumptions from the researchers understanding of previous literature and prior experiences, background and knowledge of the field. Post the review of literature in the field of children's physical activity, play and interventions the outlined research methodology has been developed from a pragmatic perspective, taking into account the ontological position that it is assumed Foundation Stage children participate in physical activity on the school playground and concurrently from an epistemological stance that this research will generate knowledge on the impact of playground markings as an intervention. The pragmatic approach allows for the research to question the hypothesis that the installation of painted playground markings will increase the physical activity of Foundation Stage children.

3.2 Study Participants

Two wait list control schools with no markings (*A and B*) and two experimental schools with markings (*C and D*) were selected for the study. The School selection protocol is outlined in figure 3. The wait list control schools are set to receive the intervention at a later date as part of the county-wide initiative. The experimental schools were selected based on having multi-skill zones installed in the school playground. The two control schools were yet to have the multi-skill zones installed. Schools were selected using a matched-pairs design (Ridgers *et al.,* 2007; Mitchell and Jolley, 2012). A control school was matched with a similar experimental school based on demographic criteria, such as geographical area, school population, class size and playground size. These criteria for the paired schools can be seen in Table 3 (*A and C*) and Table 4 (*B and D*).

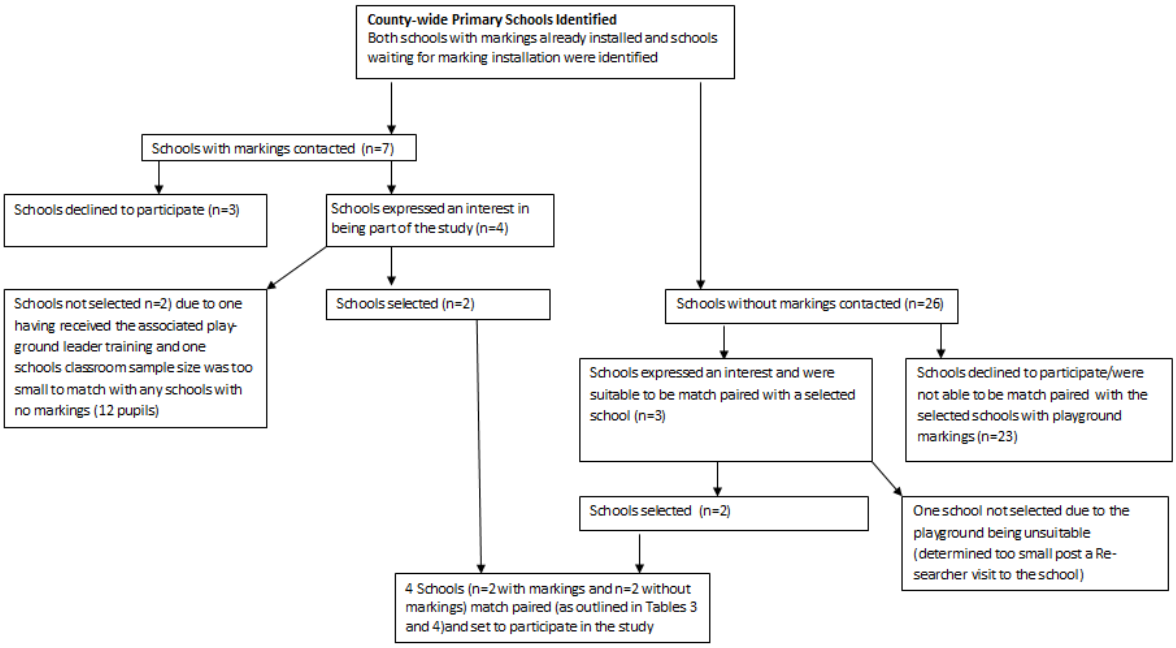


Figure 3: School selection protocol

The participant sample comprised of 77 children (*mean* = 55 months, *SD* = 7 months, *N* = 39 male, *N* = 38 female) attending four primary schools (A, B, C and D) in the Lincolnshire area. The twenty youngest children from the Foundation class of each school were selected; data from eighteen participants from school C were used and nineteen participants from school A as, following validation in the analysis stage, data from three participants was unusable. This was due to an undetermined malfunction with the accelerometers worn by these participants and the devices captured no participant data on multiple days. Although, the accelerometers collected participant readings for two or three days of data collection, however on one or two days returned a part reading or zero count for physical activity, despite the accelerometer being worn throughout the day and initialized as per protocol. See Table 2 for participants by school, age and gender.

Table 2: Participant age (mean ±SD), and number of each gender from each school

	No Markings		Markings	
	School A	School B	School C	School D
Age (months)	44 ±4	59 ±3	57 ±7	59 ±4
Females (*N* =)	11	9	8	10
Males (*N* =)	8	11	10	10

Table 3: Matched-pair schools criteria for paired schools A and C

School	Markings/no markings	School size *(N*)	Class size (*N*)	AM and PM Playground size (approx. m)	Midday playground size (approx. m)	Geographical area
A	No markings	210	22	60x50	30x75	Rural
C	Markings	159	23	40x60	40x60	Rural

Table 4: Matched-pair schools criteria for paired schools B and D

School	Markings/no markings	School size *(N*)	Class size (*N*)	AM and PM Playground size (approx. m)	Midday playground size (approx. m)	Geographical area
B	No markings	300	22	30x40	60x40	Suburban
D	Markings	265	24	70x50	70x50	Suburban

The playground environments (size, areas for play) were similar for the paired schools (see Tables 3 and 4). Furthermore the play areas were of a large size with each playground having ≥55m² of space per Foundation Stage pupil (Table 5). All playgrounds consisted of a large tarmac play area, with the two experimental schools having the multi-skill training zone (brightly coloured painted playground markings) installed on the playground. Experimental school C had the markings installed for approximately 36 months and school D for approximately 24 months. Therefore, the children were familiar with the markings in the playground, eliminating any limitation of a novelty effect that may have occurred post installation of the markings (Ridgers *et al*, 2007). The schools were of different sized populations; however the classes were of similar sizes. Therefore, this was deemed to have a minimal impact on the study.

Table 5: Playground size ratio of metres squared to each pupil

School	AM and PM Playtimes m^2:pupil	Midday playtime (MD) m^2:pupil
A*	136:1	102:1
B*	55:1	109:1
C	104:1	104:1
D	146:1	146:1

*Different playground used for AM and PM playtimes

Schools A and B had access to a different playground at morning (AM) and afternoon (PM) playtimes, this is highlighted in Tables 3 and 4. All playtimes, excluding afternoon playtime for schools A and C, were shared with Key Stage 1 children (ages 5-7). Playtimes were of varying lengths (Table 6); *Mean* (minutes) = AM 15.6; Midday (MD) 31; PM 14.4. At all of the schools the playtimes took place during a similar time on each school day with the AM and PM breaks lasting around 15 minutes and the midday lunch break lasting around 30 minutes; however the length of the play periods for each school were not standardised as the time spent on the school playground differed depending on factors such as how long the class took to get ready to go outside or if the lessen prior to playtime over-ran. A single Physical Education lesson of 1 hour took place at each school during the data collection week for 1 hour during the course of the week (Schools A and D on the 4th day and Schools B and C on the Friday). Physical Education lessons were held indoor in the school hall or gym.

Table 6: Playtime lengths for AM, MD and PM play periods (mean ±SD) and mean total minutes in playtime

School	Morning Playtime (AM) in minutes	Midday playtime (MD) in minutes	Afternoon Playtime (PM) in minutes	Total Minutes in Playtime
A	16 ± 3	30 ± 0	12 ± 2	58
B	15 ± 1	32 ± 3	16 ± 1	63
C	14 ± 1	33 ± 2	15 ± 6	62
D	18 ± 2	29 ± 3	15 ± 3	62
Mean	**16 ± 2**	**31 ± 3**	**14 ± 4**	**61**

The markings installed in schools C and D were installed as a 'Multi-skills Training Package'. Alongside the installation of the multi-skill zones the local authority worked in conjunction key partners to provide a comprehensive series of associated training for teachers, teaching assistants, play-ground supervisors, young leaders and parents, to maintain the impetus of a multi-skills approach. The two experimental schools (*C and D*) with markings installed had not yet received the associated training. Therefore, it can be determined if any changes in activity or behaviour are due to the installation of markings and not any other external factors.

Consent was received from all parents of the children participating, from all teachers/teaching assistants and supervisors who were interviewed and also permission was granted from the head teacher of each school for the researcher to conduct the study. All were informed of the aims of the study, protocol and procedure. Assent was also received from the children participating in the study through a preliminary visit to each school by the researcher. During this visit the children, class teacher/teaching assistants were verbally informed by the researcher the purpose of the accelerometers (taking into consideration the age of the participants) and during the study period what they needed to do in regards to wearing the devices, and that if they wanted to could stop wearing the accelerometer at any point (in this case a replacement child would be selected). Children were informed to see the researcher if their accelerometer belt came off or needed adjusting. Children were also given an opportunity during the preliminary visit to familiarise with the accelerometer by wearing the device, further aiming to reduce any novelty effect of wearing the belt. None of the children selected for inclusion in the study refused to wear/asked to stop wearing an accelerometer. Ethical approval for the study was granted by the University of Lincoln Research Centre.

3.3 Measures

As previously stated the study used a threefold multi-method approach combining Actigraph Accelerometers, SOCARP observations of participants and semi-structured interviews with teachers/teaching assistants and playground supervisors. The following sub-chapters will provide in depth information on each data collection method and the protocols followed in the justification for their implementation. The data collection protocols utilised within the school for each study method are outlined in figure 4.

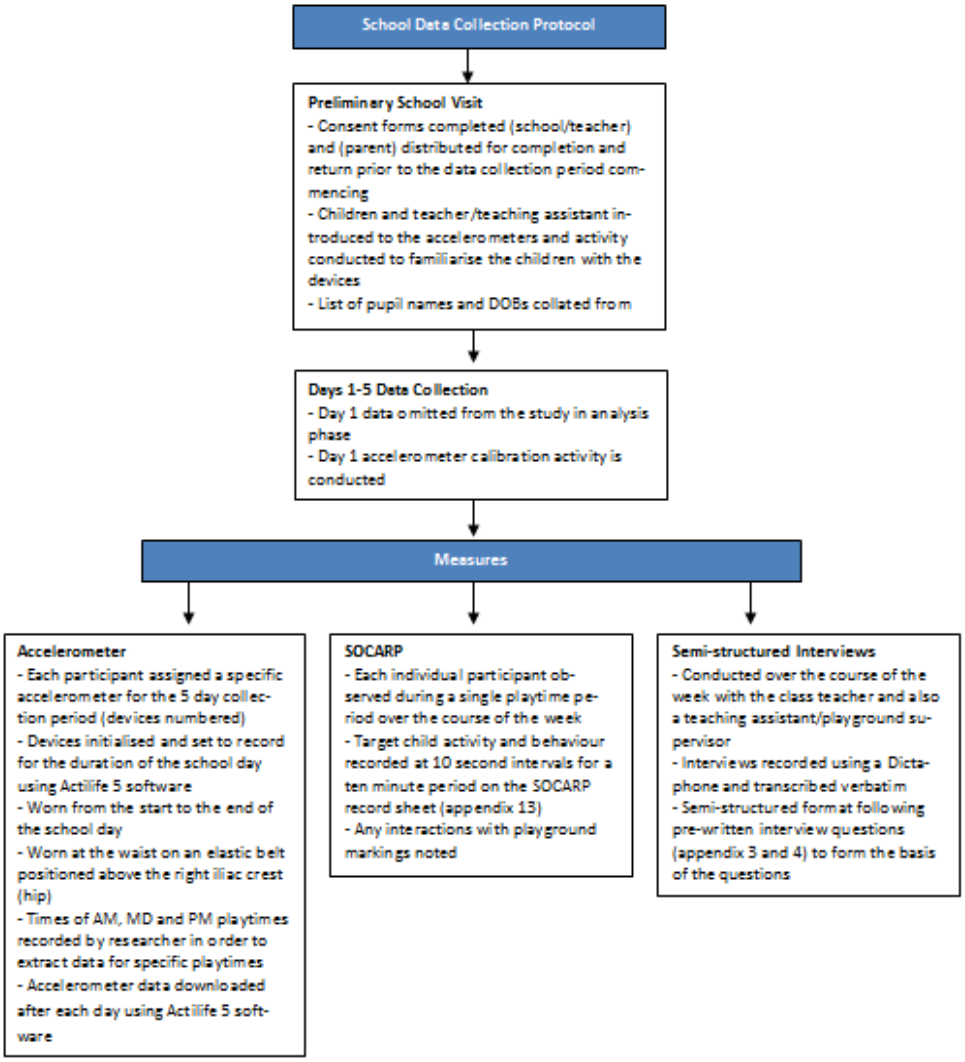


Figure 4: School data collection protocol for multiple measures

3.3.1 Actigraph Accelerometers

Participants wore accelerometers (GT3X+ Tri-Axis Actigraphy Activity Monitor, Florida). To obtain meaningful data on time children spent in varying physical activity level intensities, age relevant vector magnitude count cut-points were set; as physical activity level intensities vary for different age groups. The cut-points utilised for this study were set by Sirard *et al*., (2006) for 3-5 year old children. A modification of the Child Activity Rating Scale (CARS) (Oliver *et al.,* 2009; Puhl *et al.,* 1990), adapted to include the relevant intensity category was used as the criterion for measuring physical activity (Sirard *et al.,* 2006). Observed structured activity and intensity category are presented in Table 7.

Table 7: Child Activity Rating Scale criteria activity, observed structured activity and intensity category (amended Sirard *et al*., 2006)

Child Activity Rating Scale Criteria Activity	Observed Structured Activity	Intensity category
Stationary/motionless	Sitting and talking	Sedentary
Stationary/movement of limbs or trunk	Sitting and playing	Sedentary
Slow/easy movement	Slow walking	Light
Moderate movement	Fast Walking	Moderate
Fast movement	Jogging	Vigorous

Cut-off points for sedentary, light, moderate and vigorous intensities are established for 3, 4 and 5 year old children (Sirard *et al.,* 2006) (Table 8).

Table 8: Age-specific Accelerometer count cut-points for PA intensity categories (Sirard *et al.*, 2006)

Child Age(Years)	Intensity Category	Activity Count
3	Sedentary	0-301
4		0-363
5		0-398
3	Light	302-614
4		364-811
5		399-890
3	Moderate	615-1230
4		812-1234
5		891-1254
3	Vigorous	≥1231
4		≥1235
5		≥1255

For this study accelerometers were set to the shortest epoch setting available of 10 seconds. The data was subjected to data cleaning by running wear time validation using Actilife 5 software (Actigraph, Florida). Wear time validation was completed to aid in verifying consistency of data being recorded; such as showing if the accelerometer is continually being worn by the participant or showing sustained bouts of zero (vector magnitude) counts of physical activity. If zero counts lasted for 20 consecutive minutes or more this would indicate 'non-wear time' and the total 'missing' counts for these periods represented a

duration that the monitor was not worn (Ridgers *et al.,* 2010). Running wear time validation also highlighted any corrupted files. Data was reduced by discounting corrupt and missing accelerometer files. Percentage of time that children engaged in each activity category was obtained by running the data through Actilife 5 software (Actigraph, Florida), age related cut-points were applied to the 3, 4 and 5 year old children's raw data sets to gain age specific measures (Table 8).

A specific accelerometer was assigned to each child of each participating school. Each morning accelerometers were attached to an elastic belt and worn at the waist, positioned laterally above the right iliac crest (Oliver *et al*., 2009) as outlined to be the optimum position to pick up activity and movement. Accelerometers were worn throughout the day, for consistency and familiarity, put on at the start and removed at the end of each school day (300 ±15 minutes). The physical activity levels (vector magnitude counts) at AM, MD and PM play periods were retrieved from the data collected. Accelerometers were initialised the preceding day to data collection and data exported the day of data collection using Actilife 5 data analysis software (Actigraph, Florida).

3.3.2 SOCARP

The System for Observing Children's Activity and Relationships during Play (SOCARP) is used to gain insight into the activity types and social interactions of the seventy-seven children through a researcher systematically observing and recording their play behaviours. This time sampling technique allowed for children to be monitored for discrete periods of time (Welk, 2000) and the dimensions of their physical activity and play behaviours to be recorded simultaneously (Shumaker *et al.,* 2009). SOCARP allows for children's activity level, group size, activity type and social interactions to be recorded using set codes at 10 second intervals for a period of 10 minutes. The use of observation also provides detailed contextual information (Oliver *et al.,* 2007) on the overall playground environment (Ridgers *et al.,* 2008).

All seventy-seven children's activity was monitored, recording each individual child's behaviour in a single period of observation. For an example of the SOCARP recording sheet used (see appendix 13). SOCARP data was quantified and entered into EXCEL software (Microsoft, 2007); Excel software was utilised as multiple data sheets were coded and linked in order to streamline the mass data collected and customised macros were applied to obtain the percentages that each child spent in each SOCARP category, activity level, group size, activity type and social interactions. Utilising the analysis procedure outlined by Ridgers *et al.,* (2010) the proportion of time children engaged in a sedentary state and LMVPA (light, moderate, vigorous physical activity) can be determined. Sedentary behaviour is defined as the sum of lying down and sitting play, light as standing and stationary locomotor activities, moderate activity being walking and running/skipping being vigorous activity, as outlined in CARS (Table 7).

The SOCARP protocol outlined by Ridgers *et al*., (2010) was followed in this instance. Each child was observed for a ten minute period during a single playtime. Each playtime a target child from the sample was selected and observed. For each child that was selected, a second one was identified as a potential replacement in case the original child became unavailable on the playground (Ridgers *et al.,* 2010). Observations were also paced using audio cues from an MP3 player; a beep signalled each 10-second interval. The target child's activity level, social group size, activity type, and social interactions were observed during each 10-second observation interval and recorded during the following 10-second recording interval; this cycle was repeated for the 10-minute period.

3.3.3 Semi-structured interviews

Five playground supervisors, two class teachers and one teaching assistant took part in a one-to-one semi-structured interview (see appendix 2 for role breakdown by school) to gain insight into their perceptions of the dynamics of children's play and any noted effect of the installation of playground markings (see Appendices 3 and 4 for interview questions). Interview questions were developed to explore perceptions on children's physical activity and play behaviours in the school playground as well as the perceived or anticipated impact of installing playground markings. Interview questions were designed as starting points to prompt conversation and the semi-structured format utilised to allow further questions. All interviewees were asked the base questions with interviewee responses guiding further dialogue.

Interviews were conducted with all interviewees in a school classroom. Class teachers were interviewed at the end of the school day and teaching assistants/playground supervisors interviewed during free-time within the school day. Interviews are utilised to gauge perceptions on children's activity levels by proxy as validated by (Hands *et al*., 2006). Interviews lasted between 4 and 15 minutes and were recorded utilising a dictaphone (Olympus VN-2100PC Digital Voice Recorder, Essex, UK). The interviews were anonymised and transcribed verbatim (see appendices 5-12 for interview transcripts). The transcripts were then entered into the qualitative data analysis software, NVivo (Version 8, QSR, Southport UK), and subjected to inductive thematic analysis, following the thematic analysis process outlined by Braun and Clarke (2006) to establish codes, themes and pinpoint relationships between findings. The transcripts were analysed using an open coding method to remain inductive in the process off pinpointing themes and relationships.

3.4 Procedure

Field data collection was conducted over a four month period (November-February). Weather is highlighted by as a factor that could potentially influence and limit the levels of activity (Irwin *et al.,* 2009, Brockman *et al*., 2011) and affect types of behaviour (Ridgers *et al.,* 2009); therefore the present study was conducted over the same season. Throughout the study period, the weather was consistent having a minimal impact on the study; all play times were conducted outside. There was no adverse or heavy weather conditions experiences (rain/snow/sun) with the average temperature during the data collection period being 11˚c (local temperature was recorded at the beginning of each school day).

Data were collected over 5 consecutive days. The accelerometer data collected was reduced by discounting the first day's findings to minimise the impact and limitations of the Hawthorne effect that may have been experienced by the participants in wearing the accelerometers and the presence of the researcher. To further minimise this impact, prior to the study period a preliminary visit was made to each school, where the head/class teacher/researcher introduced the study procedure and the participants were introduced to the accelerometers.

Teachers and teaching assistants were responsible for overseeing AM and PM play periods and playground supervisors oversaw MD play times. Teachers/teaching assistants and supervisors were free to engage with children on the school playground, however interactions were few and generally in relation to their roles of playground management and ensuring child safety.

Prior to recording observations of the activities of the participants the researcher ran a protocol recording session to familiarise themselves with the time sampling technique. The SOCARP data recorded was validated by an experienced secondary researcher who recorded the same children at school A for one day of data collection to determine reliability and inter-observer agreement. SOCARP recordings were taken interval-by-interval at the same time, observing the same target participants and using the same audio cue recording. The minimum accepted level for inter-observer agreement is recommended to be >80% (Ridgers *et al.,* 2010). In this instance inter-observer agreement was 89.7%.

The Shapiro-Wilk test was run to establish if the Accelerometer and SOCARP data collected was normally distributed (alpha level set at 0.05). The data was not sufficiently normal as 66% of the data was not normally distributed. This was shown through several data categories having outlying results with a high standard deviation from the mean for child activity level. However it is justified that these outliers are retained within the data sample as they are considered not to be random discrepancies but to represent the sporadic nature of the participant's physical activity levels. Therefore, as the data was not normally distributed, non-parametric tests were selected to analyse the data.

4. Results

The following chapter will outline the results obtained for Accelerometer, SOCARP and interview data, highlighting any significant impact of playground markings on physical activity and play behaviours and further contextual perceptions of interviewees. Accelerometer results have been split for male and female participants, following interviewee data stating perceptions of differing activity levels of male and female participants to allow the researcher to analysis if this is the case within the present study.

4.1. Actigraph Accelerometer Data

Results showed no significance ($p>0.05$) between the time spent in levels of activity intensity between all four schools (between, within factors, ANOVA for mean percentage of time, in minutes, spent in PA intensity).

Therefore, despite match pairing the schools, no difference in percentage of time spent in physical activity levels were reported when comparing all 4 schools and playground markings had no significant ($p>0.05$) impact on modifying the time children spent in levels of activity (from being sedentary to light, moderate and vigorous). Data for the four schools showed that at playtime children were predominantly sedentary (mean=35%), with a downward trend in percentage of time spent from sedentary to each activity level vigorous (Table 9).

The results for mean time children spent in physical activity intensities (see Figure 4) showed a significant interaction for School A for light and moderate activity. Mean percentage of

time for school A spent in light activity was 21% (±4) and moderate was 31% (±8). These interactions deviate from the pattern for PA intensity shown by schools B, C and D. Results displayed in Table 9 depict data for percentage of time spent in PA intensities at playtime and show a similar pattern for time spent in PA across the whole school day.

Table 9: Mean (± SD) percentage of time in activity intensities for each school over the 4 day period of data collection; playtime and across the whole school day

	Playtime time in activity (% mean, ±SD)				Whole Day time in activity (% mean, ±SD)			
	Sedentary	Light	Moderate	Vigorous	Sedentary	Light	Moderate	Vigorous
School A	33 (±12)	21 (±4)*	31 (±8)**	15 (±7)	56 (±7)	19 (±3)*	18 (±4)**	6 (±3)
School B	36 (±6)	30 (±4)	17 (±4)	17 (±6)	60 (±7)	23 (±3)	9 (±3)	8 (±2)
School C	38 (± 7)	31 (±3)	17 (±3)	14 (±4)	58 (± 5)	24 (±2)	10 (±2)	8 (±2)
School D	33 (±9)	28 (±3)	20 (±5)	19 (±6)	57 (±6)	23 (±3)	11 (±3)	9 (±2)
Mean	35	28	21	16	58	22	12	8

* Interaction value less than schools B C D; ** Interaction value greater than schools B C D

The same interactions shown in Table 9 at playtime for school A are also apparent in the whole day data. The standard deviations for schools B, C and D do not cross the mean and standard deviation values for School A.

Tables 10-13 present a breakdown of percentage of time spent in physical activity intensities combining the three playtimes per study day for each participant by their school. The sporadic nature of child activity is shown by the high levels of standard deviation from the mean across the class participants and peaks and troths in individual activity.

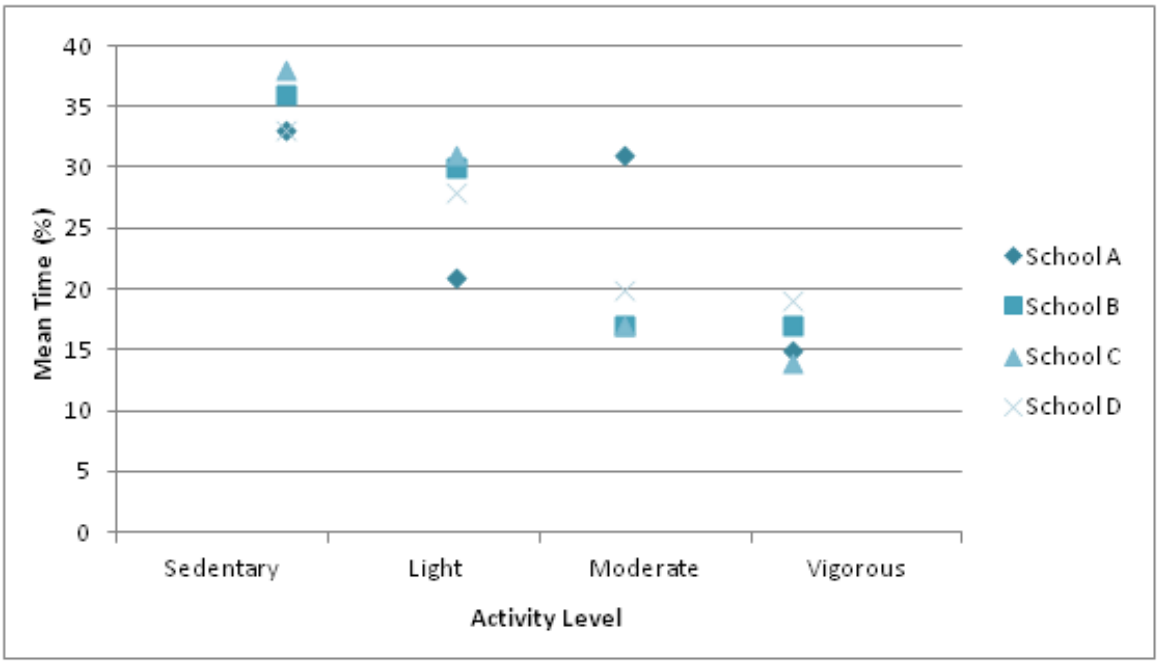


Figure 5: All participants' percentage of time in PA intensities at playtime

Table 10: Mean percentage of time spent in each activity intensity over all three playtime periods on each school day of recording for School A participants

	Day 2				Day 3				Day 4				Day 5			
Participant	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig
A1	24	19	51	7	36	15	34	14	17	21	53	8	29	19	44	8
A 2	21	25	31	23	26	21	40	13	16	24	35	25	27	25	31	17
A 3	43	19	26	13	46	25	19	10	43	20	22	15	45	21	23	11
A 4	32	21	34	13	46	21	25	8	38	21	32	8	38	21	31	10
A 5	21	18	42	18	34	19	27	19	23	18	38	21	28	19	36	17
A 6	15	24	50	11	26	21	42	11	21	17	47	14	22	22	43	13
A 7	33	22	37	8	41	22	25	12	13	15	49	22	36	22	30	12
A 8	21	25	31	22	37	23	24	16	25	23	37	15	27	24	32	18
A 9	15	12	52	22	30	18	38	15	13	14	50	22	20	15	45	19
A 10	38	19	24	19	44	17	20	19	33	12	26	29	35	17	25	23
A 11	42	28	27	3	38	29	24	10	33	22	31	14	37	26	28	8
A 12	28	17	32	23	17	21	37	25	14	14	35	36	19	17	36	28
A 13	31	29	36	4	52	18	22	8	48	18	30	3	44	22	29	5
A 14	28	23	28	21	43	27	23	6	23	17	29	31	33	25	31	12
A 15	20	24	45	11	35	18	33	14	17	27	45	11	25	23	41	11
A 16	38	23	35	4	54	24	18	5	54	16	28	1	30	21	34	15
A 17	18	17	38	27	29	20	30	22	23	17	31	29	22	18	33	27
A 18	38	37	22	3	44	24	16	16	29	27	18	27	40	28	19	13
A 19	14	25	33	27	42	24	15	19	26	25	17	32	27	25	20	27
A 20*	87	10	2	1	No data	No data	No data	No data	No data	No data	No data	No data	72	21	19	1
Mean (SD±)	27(9)	22(5)	36(9)	15(9)	38(9)	21(4)	27(8)	14(5)	27(12)	19(4)	34(11)	19(10)	31(8)	22(4)	32(8)	16(7)

*Participant omitted from study due to insufficient data recording

Table 11: Mean percentage of time spent in each activity intensity over all playtime periods on each school day of recording for School B participants

	Day 2				Day 3				Day 4				Day 5			
Participant	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig
B1	26	28	24	22	69	11	9	11	31	32	16	22	38	24	17	21
B 2	29	38	17	17	39	42	12	8	50	27	9	14	43	35	11	11
B 3	19	34	20	26	31	31	17	21	31	32	20	17	24	32	21	24
B 4	24	30	21	25	70	14	4	12	32	32	17	19	37	25	17	22
B 5	24	28	12	36	22	38	16	25	47	28	9	16	32	30	12	26
B 6	32	42	14	12	31	29	19	21	30	27	18	24	33	34	17	16
B 7	32	30	26	12	53	23	10	14	27	32	23	18	42	27	17	14
B 8	39	34	18	9	41	31	15	13	28	33	18	20	33	35	19	13
B 9	30	37	18	15	17	30	22	31	31	31	17	21	23	31	18	28
B 10	31	22	17	29	37	33	13	16	48	31	16	4	41	34	18	7
B 11	25	28	20	27	53	20	12	15	31	22	17	29	31	24	19	25
B 12	34	36	13	17	29	38	17	17	41	34	18	7	37	36	13	14
B 13	39	31	20	10	65	19	10	7	36	35	20	9	47	28	16	8
B 14	16	25	35	24	69	7	15	9	17	29	32	22	29	22	30	19
B 15	46	33	9	12	36	38	16	10	41	30	14	15	39	34	13	13
B 16	37	33	13	16	79	13	4	4	42	30	13	15	35	29	19	17
B 17	45	32	15	9	64	17	11	8	42	32	15	12	44	29	15	12
B 18	36	38	16	10	41	31	15	13	48	30	14	8	40	32	16	12
B 19	23	23	21	33	68	17	8	6	30	37	18	15	36	26	15	20
B 20	18	22	22	39	57	20	10	13	16	32	25	27	28	25	16	28
Mean (SD±)	30(8)	31(6)	19(6)	20(9)	49(18)	25(10)	13(5)	14(7)	35(10)	31(3)	17(5)	17(7)	36(6)	30(4)	17(4)	17(6)

Table 12: Mean percentage of time spent in each activity intensity over all playtime periods on each school day of recording for School C participants

	Day 2				Day 3				Day 4				Day 5			
Participant	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig
C1*	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
C2	19	31	21	28	51	31	11	7	56	28	12	4	45	29	15	12
C3	55	27	11	7	20	25	28	27	30	28	21	20	35	25	19	21
C4	23	33	22	22	27	32	22	19	43	34	9	14	32	33	17	18
C5	43	39	13	4	56	31	9	4	53	25	12	10	52	29	11	8
C6*	No data	No data	No data	No data	No Data	No Data	No Data	No Data	38	30	14	18	44	29	14	13
C7	21	33	26	20	54	24	14	8	47	34	7	11	41	30	15	14
C8	27	32	28	13	39	41	16	5	36	35	15	14	35	35	19	11
C9	29	36	27	8	27	23	16	34	38	30	10	22	33	30	18	19
C10	20	32	27	21	49	36	15	0	53	34	10	3	44	33	16	8
C11	25	38	21	16	15	31	27	27	29	29	29	12	26	32	24	18
C12	36	42	16	7	35	29	13	23	44	28	11	17	38	29	14	18
C13	43	25	17	16	45	28	15	13	49	30	10	11	46	26	14	14
C14	13	23	29	34	42	30	18	10	38	34	19	10	33	27	21	18
C15	26	38	20	16	28	45	21	7	28	39	19	13	29	40	18	13
C16	21	34	22	23	54	22	13	11	53	23	9	16	36	31	18	16
C17	41	23	20	15	45	36	14	5	55	27	10	8	46	29	16	9
C18	36	38	13	13	47	37	14	2	41	30	19	10	42	33	15	10
C19	28	21	22	29	20	43	23	14	54	28	13	5	36	30	16	15
C20	26	39	20	15	36	40	16	7	46	27	14	13	40	33	14	12
Mean (SD±)	30(11)	32(6)	21(5)	17(8)	38(13)	32(7)	17(5)	12(10)	44(9)	30(4)	14(6)	12(5)	38(7)	31(3)	17(3)	14(4)

*Participant omitted from study due to insufficient data recording

Table 13: Mean percentage of time spent in each activity intensity over all playtime periods on each school day of recording for School D participants

	Day 2				Day 3				Day 4				Day 5			
Participant	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig	Sed	Light	Mod	Vig
D1	67	18	4	11	22	29	18	30	21	25	20	34	41	28	13	18
D2	33	29	23	14	23	22	31	24	23	25	20	33	26	27	24	23
D3	28	22	23	27	23	20	24	33	21	31	29	19	25	26	26	24
D4	35	32	23	10	54	23	15	8	43	30	19	8	42	32	17	8
D5	55	29	9	8	34	25	13	29	33	32	16	19	42	27	12	20
D6	41	28	16	15	43	27	15	15	21	31	29	19	24	30	23	23
D7	28	29	19	24	21	24	21	33	25	27	21	26	25	27	21	27
D8	37	34	13	16	35	26	16	23	13	29	30	28	28	29	20	23
D9	26	32	23	19	30	25	21	23	13	35	24	28	24	30	23	23
D10	43	28	18	11	49	19	18	14	53	19	15	13	49	23	16	12
D11	18	25	20	37	29	18	19	35	23	19	24	33	28	21	19	32
D12	41	28	16	15	25	36	24	15	17	35	27	21	27	34	24	15
D13	43	27	15	15	29	21	18	31	20	32	23	26	30	26	19	24
D14	68	21	7	4	52	29	11	8	44	37	13	6	55	31	9	5
D15	33	31	15	21	37	24	23	16	41	29	13	17	32	29	19	20
D16	27	34	23	15	17	23	23	38	20	21	22	37	35	28	18	19
D17	27	29	20	24	32	34	21	13	26	31	23	20	31	31	20	17
D18	21	36	27	16	15	29	24	32	18	35	30	17	19	34	28	19
D19	32	32	25	12	24	31	22	24	21	30	19	30	28	30	28	22
D20	47	33	17	3	35	25	20	20	45	16	16	23	41	26	25	16
Mean (SD±)	37(13)	29(4)	18(6)	16(8)	31(11)	25(5)	20(5)	23(9)	27(11)	28(6)	22(5)	23(8)	33(9)	28(3)	20(5)	20(6)

4.1.1 Gender and Physical Activity Levels

The results for child time spent in physical activity for male and female participants, as well as participants as a collective, have been also been split for analysis due to interview responses placing a strong emphasis on differences between male and female activity. Therefore the results were subject to analysis of covariance to determine if there is a gender difference in physical activity levels.

Analysis of co-variance (ANCOVA) depicts no significance (>0.05) for between subject effects when adding the Independent variable of gender. The results show similar patterns of engagement in percentage of time spent in PA intensities as displayed in Tables 14 and 15 for percentage of time spent in physical activity intensities at playtime and for across the whole school day. The same interaction seen for school A for all participants at moderate and light activity levels (see figure 5) is also present in the results at playtime and across the whole school day for boys and girls.

Table 14: Boys mean (± SD) percentage of time spent in activity intensity during playtime for each school over the 4 day period of data collection and across the whole day

	Playtime % of time in activity (% mean, ±SD)				Whole Day % of time in activity (% mean, ±SD)			
	Sedentary	Light	Moderate	Vigorous	Sedentary	Light	Moderate	Vigorous
School A	32 (±17)	20 (±3)*	32 (±6)**	16 (9±)	52 (±6)	21 (±2)*	20 (±3)**	7 (±3)
School B	38 (±4)	32 (±3)	16 (±3)	14 (±6)	56 (±6)	24 (±3)	11 (±3)	9 (±2)
School C	36 (±7)	32 (±2)	18 (±3)	14 (±4)	59 (±4)	23 (±2)	10 (±2)	8 (±2)
School D	31 (±7)	28 (±3)	22 (±5)	19 (±5)	59 (±7)	23 (±4)	10 (±3)	8 (±3)
Mean	34	28	22	16	57	23	13	8

* Interaction value less than schools B C D; ** Interaction value greater than schools B C D

Table 15: Girls mean (± SD) percentage of time spent in activity intensity during playtime for each school over the 4 day period of data collection and across the whole day

	Playtime % of time in activity (% mean, ±SD)				Whole Day % of time in activity (% mean, ±SD)			
	Sedentary	Light	Moderate	Vigorous	Sedentary	Light	Moderate	Vigorous
School A	34 (±8)	22 (±4)*	30 (±9)**	14 (±7)	61 (±5)	18 (±2)*	16 (±3)**	5 (2±)
School B	35 (±7)	28 (±4)	18 (±5)	19 (±6)	66 (±4)	20 (±3)	8 (±1)	6 (±2)
School C	38 (±7)	31 (±2)	17 (±3)	14 (±4)	56 (±5)	25 (±2)	11 (±2)	8 (±3)
School D	31 (±10)	30 (±4)	21 (±6)	18 (±3)	57 (±6)	23 (±3)	11 (±3)	9 (±2)
Mean	35	28	22	16	60	22	12	7

* Interaction value less than schools B C D; ** Interaction value greater than schools B C D

Table 16 shows the mean physical activity intensities of boys and girl, cumulative of all four schools for data collected at playtimes. The means shown for each activity for boys and girls level in Tables 8 and 9 are varied; however the mean levels of activity intensity are virtually mirrored in Table 10. It is evident that boys and girls engaged in similar activity intensities.

Table 16: Mean Physical Activity Levels for Boys and Girls at Playtimes

	Physical Activity Level Intensity			
	Sedentary	Light	Moderate	Vigorous
Boys	34	28	22	16
Girls	35	28	21	16
Mean	35	28	22	16

4.1.2 Participant Age and Physical Activity Levels

Analysis of co-variance (ANCOVA) run with the covariate of age for percentage of time spent in PA intensities at playtime showed that there is no significance of within subject effects for child age ($p>0.05$). However, through further investigation and review of the data in graph format for light and moderate activity levels, see figures 6 (light) and 7 (moderate). School A's participants are younger (44 ±4 months) than participants from the other schools (58±5). The data for school A's participants show a different cluster of results. As previously stated, and further highlighted in relation to age (figures 4 and 5), participants from school A engage in light PA for less time (figure 6) and more time moderate activity (figure 7). Linear regression (figures 6 and 7) show evident correlation between the time spent in light and moderate activity intensities and child age in months. There is an evident trend of younger aged participants spending more time in higher intensity activity when looking at light to moderate activity levels.

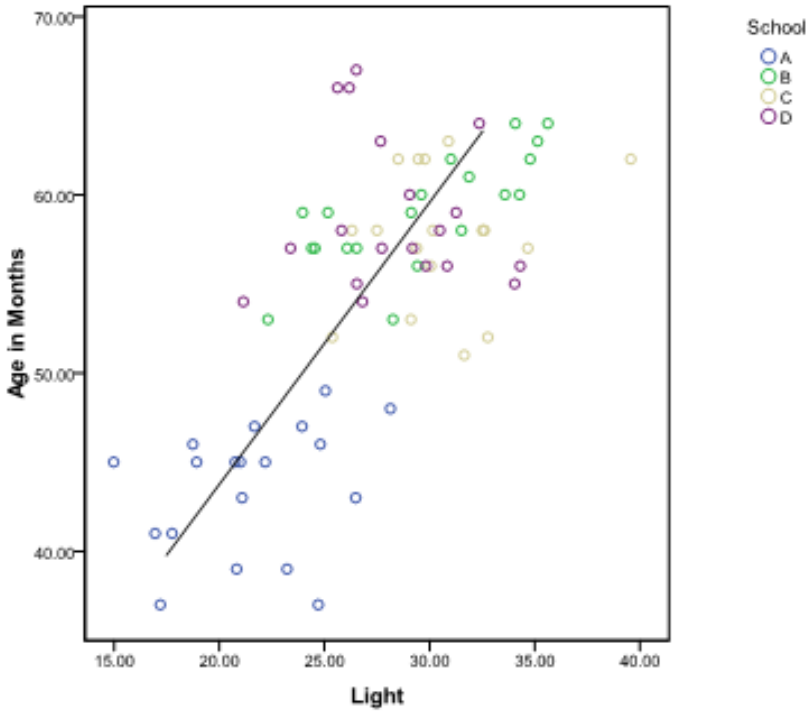


Figure 6: Percentage of time in light PA in relation to school and child age

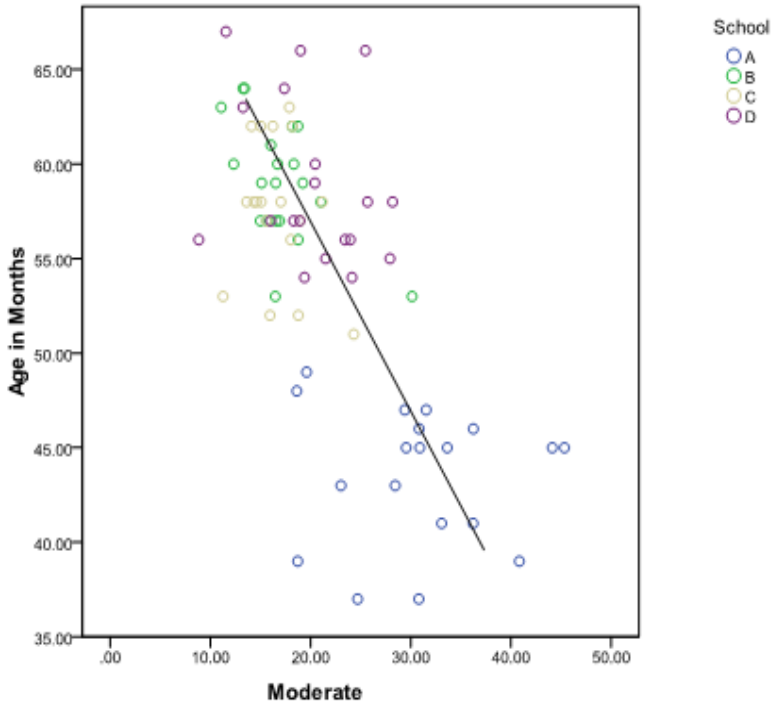


Figure 7: Percentage of time in moderate PA in relation to school and child age

4.2 System for observing children's activity and relationships during play (SOCARP)

Tests for normality reported SOCARP data for 29 categories were not significantly normal supporting the null hypothesis that the playground markings have no significant ($p<0.05$) impact on influencing the activity levels, activity types and social interactions of the participants. Through further evaluation there was a small frequency of outliers for these categories. These outliers were attributed to a small number of participants who were generally more/less active than other participants, with these behaviours being evident throughout the data collection. Therefore the outliers were not eradicated but attributed to represent the spontaneous and random nature of young children's play.

4.2.1 Physical Activity

SOCARP data for time spent in physical activity intensities as highlighted in Table 17 report the participants spending little time in sedentary behaviour (mean for all four schools being 4% of time) and the majority of time in light to moderate activity (33-35%). The data shows schools A, C and D to follow similar trends in activity but interactions ($p<0.05$) are shown for participants from school B, as they are depicted to spend more time in light activity (42 ±15%) and less time in vigorous activity (20 ±10%). The standard deviations for the levels of physical activity are high, as shown in Table 17; these may be attributed to the dispersion of data collected with some participants engaging in high levels of physical activity and others in more sedentary behaviour.

Table 17: Recorded time spent in SOCARP activity levels at playtime (% mean, ±SD)

	Sedentary	Light	Moderate	Vigorous
School A	5 (±8)	29 (±19)	34 (±17)	32 (±23)
School B	2 (±2)	42 (±15)*	36 (±13)	20 (±10)*
School C	7 (±7)	29 (±14)	34 (±17)	30 (±17)
School D	3 (±6)	30 (±14)	35 (±14)	32 (±14)
Mean	4	33	35	29

*Interaction ($p<0.05$)

4.2.2 Activity Type

Two-way ANOVE test for between subject effects and multiple comparisons show no significance between schools ($p>0.05$) for activity type amongst participants. Between subjects effects also show no significance in activity type with gender a covariate.

As depicted in Table 18 children spent the majority of their playtime in locomotor activity or sedentary behaviour with no time being spent in sporting activity and only 1% of time in School C being spent participating in a game.

Table 18: Time in activity type at playtime (% mean, ±SD)

	Sport	Game	Locomotor	Sedentary
School A	0 (±0)	0 (±0)	73 (±20)	27 (±20)
School B	0 (±0)	0 (±1)	58 (±16)	42 (±17)
School C	0 (±0)	1 (±2)	61 (±20)	38 (±21)
School D	0 (±0)	0 (±0)	68 (±15)	32 (±15)
Mean	0	0	65	35

4.2.3 Group Size

Between subject effects and multiple comparisons show no significance between schools ($p>0.05$) for social interactions. Moreover, between subjects effects also no significance ($p>0.05$) for gender when looking at group size.

Table 19 depicts that participants predominantly spent their playtime in small groups (2-4 people, *mean* 71% or alone (*mean* 17%). However, in the cases of Schools B and C children also spent 15% and 17% of time, respectively, in medium sized groups (5-9 people). From this data however, it can be seen that the standard deviations are large meaning that there is a high span of variance in the amount of time spent in each group size, reflecting the sporadic nature of children's play and unpredictable behaviour of young children's play.

Table 19: SOCARP Time in group size at playtime (% mean, ±SD)

	Alone	Small	Medium	Large
School A	21(±17)	73(±18)	6(±13)	0(±0)
School B	10(±15)	71(±26)	17(±21)	2(±7)
School C	20(±35)	65(±36)	15(±26)	0(±0)
School D	17 (±28)	74 (±27)	9 (±14)	0 (±0)
Mean	17	71	12	1

4.2.4 Social Interactions

For child social interactions between subject effects and multiple comparisons show no significance between schools ($p>0.05$). Between subjects effects also showed that there is no significance ($p>0.05$) between child genders when looking at social interactions. Table 20 shows that children typically engaged in 'no social interaction' on the playground or interacted 'verbally socially'. Participants rarely engaged in physical/verbal conflict or ignored other children.

Table 20: SOCARP Time in social interaction at playtime (% mean, ±SD)

	None	Physical Social	Verbal Social	Physical Conflict	Verbal Conflict	Ignore
School A	65 (±23)	6 (±15)	22 (±18)	2 (±4)	4 (±8)	1 (±2)
School B	54 (±15)	12 (±12)	32 (±13)	1 (±2)	1 (±2)	0 (±1)
School C	64(±16)	9 (±9)	26 (±13)	0 (±2)	0 (±1)	0 (±1)
School D	64 (±20)	4 (±5)	30 (±18)	1 (±1)	1 (±2)	0 (±0)
Mean	62	28	28	1	2	0

4.2.5 SOCARP Mode Values

Table 21 presents the mode values for SOCARP criteria. Participants at schools with playground markings (C and D) are seen to engage in more active (vigorous) behaviour with participants from schools without markings (A and B) engaging in more sedentary behaviour.

Data from all schools shows children predominantly play/stay within small groups, engage in locomotor activity (running/jumping/skipping) and have no social interactions.

Table 21: SOCARP criteria and mode values

	Activity Intensity	Group Size	Activity Type	Social Interaction
School A	Standing (Sedentary)	Small	Locomotor	None
School B	Standing (Sedentary)	Small	Locomotor	None
School C	Active (Vigorous)	Small	Locomotor	None
School D	Active (Vigorous)	Small	Locomotor	None

Mode is calculated on the most frequent category type

4.3. Physical Activity Levels

Table 23 depicts the contribution of playtime to the national guidelines for PA. From the data collected it is calculated that playtime equates to 22% (mean of all four schools) of the recommended 180 minutes of LMVPA. However, when omitting the data for Light activity and only using data for moderate-vigorous PA this value drops to 13%.

Table 22: Mean time of schools (participants) in activity levels in comparison to guidelines (whole school day)

	Time in LMVPA (mins)	% of 180mins	Time in MVPA (mins)	% of 180mins	Time Sedentary (mins)	% of the school day Sedentary
School A	154	86	86	48	198	56
School B	158	88	69	38	232	60
School C	152	84	67	37	208	58
School D	152	84	70	39	207	57
Mean	154 (±3)	86(±2)	73(±9)	41(±5)	211(±15)	58(±2)

LMVPA is time spent in light + moderate + vigorous physical activity

MVPA is time spent in moderate + vigorous physical activity

Table 23: Mean time of schools (participants) in activity levels in comparison to guidelines (all play times over a day)

	LMVPA % of Playtime	LMVPA mins of Playtime	% of 180mins	MVPA % of Playtime	MVPA mins of Playtime	% of 180mins	% of Playtime Sedentary	Mins Sedentary
A	67	39	22	46	27	15	33	19
B	64	40	22	34	21	12	36	21
C	62	38	21	31	19	11	38	22
D	67	42	23	39	24	13	33	19
Average all schools	65 (±2)	40 (±1)	22 (±1)*	38 (±7)	23 (±3)	13 (±2)	35 (±2)	20 (±1)

LMVPA is time spent in light + moderate + vigorous physical activity

MVPA is time spent in moderate + vigorous physical activity

*Time in LMVPA at playtime equates to 22% of 180 minutes

** Time in MVPA at playtime equates to 13% of 180 minutes

4.4 Interviews

Semi structured interviews conducted with 8 members of staff (2 from each school, see appendix 2 for breakdown). Inductive thematic analysis, executed with the aid of NVIVO software (Version 8), showed that the teachers/teaching assistants/playground supervisors identified four predominant dimensions of play behaviour and physical activity in the playground. These four main dimensions are built from the relationships of thirty-six major themes derived from the coding and categorisation of the interview transcripts and the recognition and interpretation of patterns (Tables 25-28).

The four major themes identified to impact PA and play behaviours in relation to the playground and the installation of playground markings were:

- The characteristics of the child
- Perceptions of playground markings
- The ecological environment (social/physical)
- The perceptions of child physical activity

Table 24 highlights the frequencies of the key themes of the interview data in relation to 4 major areas outlined. Further, to this the key themes and quotes in relation the four major areas as outlined above are highlighted in Tables 25-28. These findings will be further examined and analysed in relation to the accelerometer and observation data in the subsequent discussion.

Table 24: Interview Themes and Frequencies

Theme	Frequency
Child confidence and personality are key factors in being physically active, interacting with other children in the playground and exploring	**16**
Child interactions – children generally play in the same groups however some are recognised to be 'social butterflies' who interact with other children dependant on what they are playing	**8**
Imagination is a key aspect of young children's play	**11**
imitation and Impact of popular culture on play	**11**
Play is a free choice	**4**
Knowledge and cognition to use markings	**4**
Learning resource – School A (without markings) state that markings will allow the playground to be used as a learning space	**4**
Long-term impact of markings – Both schools without markings stated the markings will have a long-term affect if the children see value in them	**4**
Markings not used – Both schools with markings stated that they are not used by the foundation stage children	**6**
Markings as a stimulus for play – Schools without markings stated that they will be a stimulus for play	**11**
Modelling	**5**
Schools with no markings have positive anticipation	**3**
Short-term impact of markings –Schools without markings recognise there may be a novelty effect post installation	**4**
Supervisor training – Schools see the value in the associated training package	**7**
Impact of equipment – equipment may impact the type of activity engaged in but not necessarily children's activity levels	**8**
Play needs to be more structured around environment – young children need more direction	**24**
Playground management	**10**
School environment	**4**
Supervisor interactions	**26**
Weather impact – The weather has a limited impact on PA levels	**13**
Working with young leaders	**8**
Boys are very active – Boys were stated to be more active than girls	**8**
Children are generally active - 7/8 interviewees stated that children were active at playtimes	**23**
Children could be more active - One interviewee stated that they thought the children at their school could be more active	**4**
Girls play activity – Girls were stated to be less active	**2**

Table 24: Key themes and quotes for child characteristics

Theme	Code Frequency	Example Quote
Boys behaviour	2	DS01 'I know some of the boys love running games and they have races to the shed, tap it and run back. They are quite competitive like that!'
Child confidence	16	BS02 'I think it depends on their personality [how active they are]' DS02 'when they first come it is quite daunting to go into the big playground. What we usually do is corner off a part of the playground, like cone some off at lunchtime so that's just their area. But this year it's been one of the years when no one has just played in that area and explored the whole playground. Last year we had children who didn't want to go outside cus there were loads of children'
Child interactions	8	DS02 'I think they stick to mainly the same friendship groups unless they want to play something completely different'
Imagination	11	DS02 'It's a big part of it [using imagination]'
Impact of popular culture on play and imitation	11	CS01 'Make games around their interests , like Ben 10 and stuff like that, what's popular' BS02 'Sometimes if they have clicked onto something they have done in the classroom, or in a dance lesson, they will imitate it outside as best they can'
Nature of Class	2	DS02 'This year they are one of my most active classes'
Gendered play activities	6	DS01 'The girls like the skipping ropes and things like that'
Play behaviour	7	DS01 'But when there's plenty things going there's none of that [bad behaviour] cus they are all busy'
Play is a free choice	4	BS01 'It will depend on the children really. WE can't force them to go and play on them'
Knowledge and cognition to use markings	4	DS02 'I think you've got to know how to use them [playground markings], be there to try and make a game up with them, they are good for us, but the children don't really know how to act with them, not a young age anyway'

Table 25: Key themes and quotes for perceptions of playground markings

Theme	Code Frequency	Example Quote
Hopscotch	8	DS02 'the main thing that helps on the playground is the hopscotch, the children like the hopscotch, the other things they don't use as much'
Learning resource	4	AS02 'it would enable us to use the playground more for a learning space'
Long-term impact of markings	4	BS02 'if they're [the playground markings] something they [the children] see value in they will last'
Markings and playground behaviour	1	BS02 'I think behaviour will improve; in they will be more occupied'
Markings and social interactions	1	DS02 'it [playground markings games] gets more children involved, especially having so many people out there at lunchtime'
Markings not used	6	DS02 'to be honest no [the markings do not make much difference to how active they are]'
Markings as a stimulus for play	11	BS02 'it's [playground markings] a stimulus; it's a prompt to get them thinking, getting them sociable and active'
Modelling	5	DS02 'I think us as teachers and adults you need to model them and then provide the equipment for them to use them again'
Schools with no markings have positive anticipation	3	BS02 'yes, we are looking forward to it [installation of markings]'
Short-term impact of markings	4	BS01 'They will be excited, overwhelmed, it will be a novelty, everyone will want to play on them [playground markings] and then they will be back to what they were doing before'
Supervisor training	7	BS02 'because no matter how long you have been teaching you only have the experience you've come from, so finding new ways of playing games and things, that would be brilliant. Having the knowledge of how to use them, like the spiral things, there's probably a million things you could do on there'
Type of markings	1	BS01 'it depends what markings they put down. We used to have giant snakes and ladders and they all played round and they did love that, but it all depends what they put down'
Use of markings	1	CS02 '[supervisors] sometimes set up games using the squares'

Table 26: Key themes and quotes for the ecological playground environment (physical/social)

Theme	Code Frequency	Example Quote
Impact of equipment	8	CS02 'yeah play equipment [affects how they spend playtime]. If you put a box of books they would all go for the box of books but if you put out equipment they would all be running around' DS01 'I'd say equipment helps but not always , I'd say that they are playing as well if they haven't got anything there'
Play needs to be more structured around environment	24	CS02 'I think there should be a bit more focus and a bit more directed, and then they would know what they could play and how to play it'
Playground games	4	BS01 'like different activities, and it's a big variety I like to think. I like to think it's a good variety [of games they can play at playtime]'
Playground management	10	AS01 'I mean they take about ten minutes to eat their tuck don't they? So they've only got like a short playtime'
School environment	4	DS01 'I think we are quite an active school with different clubs and things and people coming in'
Supervisor interactions	26	BS02 'they need to start having more independence and you do say go and have a play, you know there's someone over there go and play with them, and you do pair those children off and encourage them to go off rather than holding onto your hand at playtime'
Weather impact	13	DS02 'yeah, it [the weather] makes a big difference on the children's attitude… but I don't know if that effects how active they are, I think it just effects their attitude'
Working with young leaders	8	DS02 'I think that having young leaders and starting off games is good'

Table 27: Key themes and quotes perceptions of participant physical activity

Theme	Code Frequency	Example Quote
Varied levels of activity at playtime	4	CS02 'I'd say that yeah [some groups of pupils are more active]
Boys are very active	8	AS02 'but the boys they're really off and active'
Children are generally active	23	DS01 'yes I would say so [the children are active], not many of them are static and standing around'
Children could be more active	4	AS01 'I'd say they could be more active'
Girls play activity	2	DS02 'and it is the girls that sit down and talk and make up games'

5. Discussion

This chapter aims to discuss the research findings in relation to the study aims of identifying the impact of the installation of painted playground markings (multi-skill training zone package) as part of a county-wide initiative on getting inactive children engaging in higher intensities of physical activity and reporting how active Foundation Stage children are within the school playground and to what extent playtime contributes to children participating in daily activity recommendations. Each subsequent section will outline the findings for physical activity, play behaviours and the play environment linked to any effect the markings may have had on these dimensions of play. The findings from the present study will not only be discussed but also compared to existing studies highlighted within the literature review to identify any concurrent or conflicting results and themes. The methodology utilised will also be discussed, aiming to highlight the strengths, weaknesses and any limitations in the research design. As per the pragmatic research strategy outlined in the study methodology, the three study strands will be linked in the subsequent discussion chapter. Ultimately, the implications of the findings, in respect of the contribution to current knowledge and the development of effective playground interventions will be highlighted and areas, ideas and directions for future research identified.

5.1 Summary of key Findings

The study results from the multiple methods utilised reported 7 key findings in relation to the study aims of measuring the impact of playground markings on the participants' physical activity levels and also their play behaviours:

- Markings had no impact on the physical activity levels of participants when comparing schools with markings to those without ($p>0.05$)
- Interviewees of schools with playground markings reported that they had no impact on the physical activity levels of children; however, schools without markings anticipated they would have a short term effect
- Participants spent most of playtime in a sedentary state 35% (mean of four schools)
- Playtime activity contributed to 22% of recommended daily physical activity guidelines
- Markings had no impact on play behaviours (group size, activity type, social interactions) as no significance was reported between schools ($p>0.05$)
- Child age is reported to effect the time spent in light and moderate activity levels as a trend was noted in the younger participants spending more time in moderate and less in light activity
- Interviewees reported a perceived difference in activity levels between male and female children, stating males to be more active in the playground. However Accelerometer data documented no significant difference in the levels of physical activity between male and female participants

5. 2 Impact of playground markings on physical activity

As highlighted in the preceding key findings the Accelerometer results recorded no statistically significant effects between all four schools and also between the paired schools ($p > 0.05$) for time spent in the four physical activity categories sedentary, light, moderate and vigorous. This shows that the installation of playground markings had no impact on increasing the physical activity levels of the participants.

It is interesting to note that perceptions of the impact of playground markings where strikingly different between schools C and D who had markings and schools A and B who were awaiting installation. Conflicting perceptions reported that schools without markings were anticipating installation whereas the schools with the markings stated that they were aware of the limited impact. This was a common theme in response from all the interviewees;

> '...it's [playground markings] a stimulus; it's a prompt to get them thinking, getting them sociable and active' - BS02

The markings are seen by the class teacher of school B to be a stimulus for within the playground whereas post intervention schools reported very limited impact;

> 'To be honest no [the markings do not make much difference to how active they are]' - DS02

As stated by the class teacher of school D above, the interviewees for schools with markings reported them to have little impact in regards to encouraging activity levels and to rarely be used by the children on the playground, reporting that the children just play over them and

need to be prompted by supervising staff or older children to interact with markings. This supports observation data where the researcher only recorded two interactions made between study participants and playground markings across the duration of the study, one interaction was initiated by a playground supervisor suggesting a small group (n=3) female participants play 'What's the time Mr Wolf' on gridlines and another occasion when an alone child was walking along following the lines.

As stated, interviewees of schools without the markings were looking forward to their installation. However, this was predominantly in relation to giving the children more to do and to make the playground environment more aesthetically welcoming rather than a focus to increase physical activity levels. Interviewees from schools with and without markings (BS01 and CS01) also noted the potential for the markings as a novelty amongst the pupils and they would not be utilised as a means to instigate active play unless the children saw value in them;

> 'If they're [the playground markings] something they [the children] see value in they will last' - BS02

This novelty effect was noted both by schools with the markings and also by interviewees from schools with the markings yet to be installed;

> 'They will be excited, overwhelmed, it will be a novelty, everyone will want to play on them [playground markings] and then they will be back to what they were doing before' - BS01

This idea of the novelty effect is echoed by Stratton (2000) as results suggested that the installation of playground markings had a significant ($p>.05$) and positive influence on children's PA as MVPA was significantly increased post installation, However Stratton reports that this effect may be attributed to a novelty effect. Furthermore, Blaes *et al.,* (2013) discuss that their study findings of significantly ($p<0.05$) increased moderate and vigorous PA levels in 6-11 post markings installation were due to the short-term impact of the intervention.

The current study assessed the impact of markings within schools C and D that had markings installed for over 36 and 24 months respectively and showed no long-term effect of children utilising the markings or recorded increases in physical activity. Consequently, it is important to not forget that the present study intervention is part of a multi-skills training zone package. Whereby the school teachers/parents/supervisors and selected young leaders were set to receive associated training by local partners to teach them how to instigate games with younger children utilising the markings. The schools with markings had yet to receive this training as part of the county-wide intervention. Anticipation of the playground markings and value of the associated training is stated by the class teacher of school B;

> 'because no matter how long you have been teaching you only have the experience you've come from, so finding new ways of playing games and things, that would be brilliant. Having the knowledge of how to use them, like the spiral things, there's probably a million things you could do on there...' - BS02

It would be of benefit as an avenue for further study to assess if this associated training delivered is utilised by targeted individuals to promote activity within the playground.

Furthermore, if this training has an impact on taking the intervention from short-term to long-term and increase child interactions, ultimately impacting on physical activity. No existing studies have explored linking the installation of playground markings with the training of individuals (teachers, supervisors, parents and young leaders) who utilise or supervise the playground and interact with children.

As highlighted in the literature review, existing studies have shown that playground markings have a positive impact on levels of children's physical activity and contributed to the rationale behind the present study (Stratton, 2002; Stratton and Mullan, 2005; Ridgers *et al*., 2007; Blaes *et al*., 2013, Crust *et al*., 2014), However these studies were conducted with older participants, and as previously suggested in Piaget's theory of play behaviour (Lindon, 2001) children show different types of engagement in physical activity and active play behaviours after the age of 6, with activity being more symbolic, sporadic and intermittent in nature during the early years (Burdette and Whitaker, 2005; Ward *et al.*, 2007). This theory between age and physically active play will be explored further in subsequent chapters. Therefore for the age group within the present study it is evident that as a solo intervention markings do not have the hypothesised impact on increasing activity amongst Foundation Stage children.

Interviewees with school staff from schools without markings stated that they were expectant of the markings to potentially promote social interactions amongst the children;

'...it's [playground markings] a stimulus... getting them sociable' - BS02

Even though the playground offers an environment for children to be socially interactive with their peers (Rink et *al.,* 2010; Zastrow and Kirst-Ashman, 2010) this perception does not reflect the SOCARP data as the markings had no significant ($p>0.05$) impact between schools on increasing levels of social play, through the researcher recording social interactions and group size of participants.

The present research found that re-designing the school playground through the installation of playground markings had no significant impact ($p>0.05$) on the activity dynamics of Foundation Stage children in relation to their social interactions, group size and activity type. As previously outlined the observer in the present study only recorded 2 direct interactions with the markings; one child was observed playing 'What's the time Mr wolf' (painted grid) in a small group (n=3) led by a instigated by a playground supervisor for 4 observation intervals and one child was observed following a painted line on their own for 1 observation interval. It is evident that the markings were not utilised regularly by the young participants. As interviewees outlined that they perceived Foundation age children to not know how to interact with the markings, whereas older children, as studies have shown reported effects (Stratton, 2002; Stratton and Mullan, 2005; Ridgers *et al*., 2007; Blaes *et al*., 2013, Crust *et al*., 2014) have more self-directed interactions with the intervention and knowledge on how to utilise the markings in play activities

5.3 Maximising the Playground Environment

The playground for both schools A and B were large tarmac surfaces with no interactive elements, play equipment or facilities to interact with. This is supported by the previously outlined ideas of Titman and McGill (1992) who state that children's activity is limited when faced with a sterile environment. However, the view that an empty environment means children engage in little activity is challenged by the class teacher of school B who asserts that children are creative in their play;

> 'Because they don't have the equipment maybe their imaginations run' - BS02

The class teacher highlights that a lack of equipment can result in children using their imagination more and engaging more so in active and creative role play. This supports the previously outlined rationale for the implementation of playground markings as an activity intervention and the assumption that they would be a stimulus for creative play (Burdette and Whitaker, 2006). However, evidence shows that the markings were not used but children may still have been engaging in creative free play in all the participating school playgrounds. Interviewee AS01, a class teaching assistant, highlighted how without the presence of markings, structures or equipment the playground was empty and children relied on their imagination and the imitation of learnt games in order to play;

> 'But there's not really anything to play with apart from playing tig and stuff like that', they need to use imagination' – AS01

Despite the installation of the markings in schools C and D it is evident that they were not utilised by the children in the study. This leads to question the effectiveness of playground markings as a physical activity intervention for young children aiming to get inactive children

more active. However interviewees shared a common perception that markings could be beneficial and engage young children if utilised as a learning resource, combined with equipment and playground structures and modelled/engaged by young leaders and adults;

> 'I think that having young leaders and starting off games is good' - DS02

This would in theory create a play environment for children where use of the markings is encouraged, through social interactions, playing games and using/sharing equipment. Aiming to flex individual creativity and prompt engagement in physical activity.

Interview data showed that playground equipment was seen as positive but not always essential, as interviewees stated that the introduction of equipment to playtimes affected the type of activity engaged in but not necessarily the intensity;

> '...yeah play equipment [affects how they spend playtime]. If you put a box of books they would all go for the box of books but if you put out equipment they would all be running around' - CS02

This perception is echoed by DS01;

> 'I'd say equipment helps but not always , I'd say that they are playing as well if they haven't got anything there' - DS01

This links to the idea that young children's use of imagination and naturally sporadic movements means equipment does not impact the intensity of their actions but more so relates to theories of learning and social interactions with their peers.

The idea that multidimensional aspects, such as young leader influence, can have an influence on play is further suggested by Stratton (2000:1538) who states that 'factors other than playground markings may also influence children's physically active play'. The perception that combining markings and the supervisor training will have a positive impact on physical activity and play behaviours is supported by Cardon *et al.,* (2009) in suggesting that supervisors will interact more with the children and in effect become play activators and less passive.

> *'[Younger children] may need more new infusions of different equipment and more guidance and encouragement to play in and active way.'*
>
> (Cardon *et al.,* 2009:338)

This is believed to, in turn, allow supervisors to develop more confidence and knowledge in prompting play activity as stated by interviewee BS02. This involvement of playground supervisors in delivering play activities is supported in the conclusions of Cardon *et al.,* (2008) who report the potential benefit to encouraging playground supervisors to promote activity during playtimes.

Interviewee CS02 stated that they perceived a need for more structure at playtime;

> 'I think there should be a bit more focus and a bit more directed, and then they would know what they could play and how to play it' - CS02

This is supported by Cardon et al., (2009) who call for play time allocation to include structured physical activity and play at moderate and high intensities. However, this is contrary to the previously stated theory of Pate *et al.,* (2008) that increased structure limits

the free-play and activity of children as they become older. Additionally this is fundamentally contrary to other interviewee perceptions that uphold the importance of free play and children's choice at playtime;

> 'It will depend on the children really. WE can't force them to go and play on them [playground markings]' - BS01

Moreover, literature (Pate *et al.,* 1996, Stratton, 2000:1538, and Stratton and Mullan, 2005) states that young children are more likely to participate in higher levels of physical activity within unstructured play environments where they are free to interact with the environment and socialise with their peers.

Short playtime periods were highlighted by interviewees at school A as an issue in regards to the opportunity to engage in physical activity. However, the play periods were very similar in length across all four schools. A study conducted by Ridgers *et al.,* (2007) concurs that playtime length my effect physical activity levels and suggested that longer daily playtime periods allowed children to engage in more activity. This consequently allowed for more time to engage in activity opportunities and also longer periods so supervisors could implement games. Increased time within the playground combined with a mixture of structured and unstructured play would allow for greater opportunity for children to engage in activity (Ridgers *et al.,* 2007). However extending playtimes may not be feasible in respect of being integrated within the school day.

Integrating aspects of structured play in the sense of using the playground markings as a learning space was positively reported by interviewees;

'It would enable us to use the playground more for a learning space' - AS02

Therefore engaging children through the use of the markings combined with equipment in the format of a teaching tool. This reflects the idea of modelling the markings to give them a sense of purpose and added value to the children. Furthermore as outlined in the literature review, Ridgers *et al.,* (2007) state that even if the installation of markings do not lead to higher levels of physical activity they can still be utilised to engage and enhance children's fundamental motor skills. However, this is contrary to the intervention aims of keeping children active and engaging inactive children in PA on the school playground.

The study findings, however, in relation to the play environment and the training of young leaders and significant adults (supervisors, teachers, parents) as part of the 'multi-skills training package' pose a play predicament of structured vs. unstructured play. As previously discussed there is importance of free-play to young children's development (Lindon, 2001). However, in order to be able to fully utilise the playground markings it is evident that young children need to be taught/engaged in games. This however puts forward the idea that if play times were to include more structured activity for Foundation aged children, would an increase in structured play cast a shadow over more creative free play. Moreover, would more time in structured play take away opportunities for children to express themselves, explore their environment, discover their limitations and develop social relationships. However a counter argument questions if some direction needed not only to ensure young

children are being physically active but also to open new doors in terms of learning new activities.

This engagement of adults in children's play reflects the principals of Vygotskys theory of 'Zone of proximal development' (Lindon, 2001); highlighting how learning through play can be supported by adults and peers.

> *'...the area of possibilities that lies between what individual children can manage on their own – their level of actual development – and what they could achieve or understand with some appropriate help'*
>
> (Lindon, 2001:31)

The playground environment therefore creates an opportunity for proximal development through playground supervisors and young leaders nurturing child development in instigating learning through games and play. However also taking a step-back and allowing opportunities for children to engage in free-play.

Ridgers *et al.,* (2007) who state that 'exposure to supportive physical environments can facilitate physical activity behaviours'. However this does not take into consideration for potential of overcrowding and overdevelopment of the playground, highlighting the need for thought out, evidenced and well-designed playground interventions. It is evident from the data collected that playground markings had no significant impact on foundation stage children's activity or behaviour. A study conducted by Cardon *et al.,* (2009:338) found that 'creating a play friendly environment may not be sufficient to promote physical activity

engagement in pre-schoolers (4-5 year old children)'. From the interviewee perceptions it is reported to be essential that children see the value in the environment around them and what is available for them to interact with. Furthermore, the play environment needs to be accessible in the sense that young children are able to actively engage with and understand their surroundings, as this was one of the main barriers reported by interviewees as to why the markings were not utilised by the participants.

Results obtained contrast with those portrayed in the study by Ridgers *et al.,* (2007) who reported that re-designing the play environment and installing playground markings are effective in increasing children's physical activity levels. However the study focused on 'elementary' aged children (participants aged 7-8 years) and therefore lending weight to the theory that young children do not know how to interact with the markings at foundation age. This is echoed by interviewees who reported that the children in the present study did not interact with the markings as they did not know how to use them or how to incorporate them into games or creative play;

> 'I think you've got to know how to use them [playground markings], be there to try and make a game up with them, they are good for us, but the children don't really know how to act with them, not a young age anyway' - DS02

As outlined this need for understanding is particularly evident with the age group targeted in this study. As highlighted in the literature review young children are developing cognitively as well as physically and even though imagination can potentially play a part in utilising more advanced equipment, apparatus or markings children are ultimately limited in their engagement with the environment and the markings have little meaning to them. However,

Interviewees stated that modelling, by playground supervisors and young leaders, may be an effective practice in showing young children games that utilise the markings and consequently demonstrating ideas for play.

This is reflected in the interview data as it is recognised that young children often imitate games and ideas for play;

> 'Sometimes if they have clicked onto something they have done in the classroom, or in a dance lesson, they will imitate it outside as best they can' - BS02

This use of modelling allows for children to combine creative and free play whilst putting into practice ideas from games they have already learnt within the playground environment. Imagination was noted by the interviewees as a key element to young children's play as the participants would make up games based on what they had seen (popular culture, TV) and also base playground activities on imitation (PE Lessons, activity sessions in class/outside of school). Therefore modelling activities to this age group could have potential benefit in encouraging interactions with the markings.

Hopscotch was a recurrent marking that was perceived positively and utilised by children and teachers as a learning tool alike;

> 'The main thing that helps on the playground is the hopscotch's, the children like the hopscotch's, the other things I don't think they use as much' - DS02

Hopscotch was stated to be popular amongst the children and used by both boys and girls

(BS02). This emphasises the theory that to have an impact the children must see value in and know how to utilise the markings; furthermore hopscotch was a commonly taught game by supervisors and peers in the playground. This suggests that, if modelled by supervisors or young leaders, supported by Cardon *et al.,* (2008) who highlights the important role of playground supervisors, and combined with playground games, markings have the potential to be more widely utilised by young children. However the observer only noted two instances where a target child interacted with the playground markings.

5.4 Physical Activity of Participants at Playtime

Across all the schools, recorded time spent in each activity level showed that children were predominantly in a sedentary state during playtime (*mean* 35%, 20 minutes of total combined playtimes across the day) and not engaging in physical activity; with the least percentage of time being spent in vigorous activity (*mean* 16%, 5 minutes). However, when looking at time spent in combined MVPA at playtime children spent *mean* 38% (23 minutes) being active in comparison to 35% (20 minutes) being in a sedentary state, including being stationary play, standing and sitting. This finding is positive when compared to physical activity levels reported in a study conducted by Cardon *et al.,* (2009).

As outlined in the literature review young children (*mean age* 5.3years) have been reported to spend 11.2% (4.7 minutes) of time in MVPA and 61.3% (25.7 minutes) in sedentary activity during play time and study conducted by Hannon and Brown (2008) assessing the physical activity levels of 3-5 year old children report that participants engage in MVPA for 18% of playtime and spend 49% of their sedentary. The present study and both those

conducted by Cardon *et al.,* (2009) and Hannon and Brown (2008) all utilised accelerometry and the same accelerometer count cut-points for physical activity levels as outlined by Sirard *et al.,* (2005). The difference in activity levels to the studies conducted by Cardon *et al.,* (2009) and Hannon and Brown (2008) could be attributed to the researchers using 15 second epochs, as opposed to 10 second epochs selected in the present study. This results in fewer activity intervals being captured. Meaning the present study is more likely to capture a true picture of the participants' activity as Oliver *et al.,* (2009) state that short epochs better reflect the intermittent activity of early year's children.

The finding that participants engaged in MVPA for 38% of playtime supports the interview data. As seven (out of the eight) interviewees stated that they perceived the majority of children to be active at playtimes, based on their experience of observing children on the playground;

> 'The children, I would say the majority of them are up and active, I would say the majority' - AS02

One Interviewee (AS01) stated that they thought the children could be more active in the playground:

> 'I think they could be more active, I don't think they are that active to be fair '- AS01

The school of the interviewee, school A, showed an interaction for children spending more time in moderate activity and less time in light activity, with the measures for the other intensities being similar to the other schools. Therefore findings show that generally children from school A were more active by engaging in higher levels of moderate, rather than light,

intensity activity. However the interviewee perceived that the levels of child activity in the playground could be increased. Interviewee AS01, who was a class teaching assistant and assisted in supervising children at playtimes, also stated causes that they perceived to affect the activity levels of the children. These included the amount of time they were free to spend eating their playtime snack and also the playground being an empty space with the only activity available for children to participate in being to 'run around'. The amount of time children spend in the play ground is also discussed by Ridgers *et al*., (2007) who put forward the idea that longer playtimes allow children to engage in more active play, also spend more time interacting with the playground in addition to time that may be spent in organised break activity, such as snack time. Therefore these other factors may be informing the interviewee's perceptions of child activity.

Objective data collected showed that children from School A engaged in higher levels of moderate activity in a very limited play environment, in respect to aspects such as equipment and markings. As outlined these stimuli for pay are often believed to prompt physical activity and vary the type of activity children participate in (Stratton, 2000; Ridgers *et al.,* 2007, Ridgers *et al*., 2010). The lack of available stimulus may have influenced the interviewee's perceptions on children and linking this with perceiving low levels of inherent activity as at each playtime they are participating in the same day to day activities. However, they may be utilising their imaginations or playing taught games

5.5 National Physical Activity recommendations

In relation to the study aim of looking at how active Foundation Stage participants are within the school playground, the amount of time playtime contributes to engaging in the recommended levels of 180 minutes of intermittent LMVPA (Chief Medical Officers, 2011) can be determined. It is also possible for the researcher to assess how active participants were over the whole school day due to the accelerometers being worn from the start to the end of each day.

Table 22 depicts the contribution of playtime to the national guidelines for PA. Findings show playtime equates to 22% (mean of all four schools) of the recommended 180 minutes of LMVPA which is a positive figure as playtimes only comprise of around one hour the child's day (*mean*=61 minutes of playtimes in the present study). However, when omitting the data for Light physical activity, as light activity can be considered inactivity (British Heart Foundation, 2012), and only considering moderate-vigorous PA this value drops to 13%. Furthermore, as highlighted in the literature review this time spent in LMVPA could all be light activity and a child would still be considered to meet the daily target. The National Association for Sport and Physical Education (2002) suggest that pre-school aged children accumulate at least 120minutes of PA per day half in structured and half in unstructured PA/free play settings and more recently the Department of Health and Physical Activity, (2004) suggests engagement in 60minutes of moderate to vigorous PA per day is most beneficial. Both these recommendations are substantially less than most recent recommendations; furthermore as outlined in the review of studies it is difficult to monitor structured and unstructured activity.

In relation to the present study this shows that playtime contributes to almost a quarter of children's recommended daily activity and the presence of playground markings have no impact on increasing the time children are spending active on the school playground. There exists scope to develop further evidence based interventions that encourage physical activity on the school playground and also study into the impact of the associated play ground training. However, in relation to activity levels achieved over the whole school day the majority of children hit a high percentage of the recommended daily levels. Utilising the accelerometer data collected, the time participants spent in activity levels compared to the recommended national guidelines, 180 minutes of LMVPA each day (Chief Medical Officers, 2011) report that all children (n=77) reached ≥84% of the 180 minutes of recommended activity when utilising the guidelines for total time spent in light, moderate and vigorous physical activity (LMVPA). However, only 10 children overall engaged in ≥50% of 180 minutes when guidelines are limited to just moderate-vigorous PA (MVPA). Table 21 highlights that children spent ≥56% of the school day in a sedentary states. At present there are no studies critiquing these guidelines. There is scope to questions if there is a need to further increase levels of physical activity on the playground, as the majority of participants were already active, or whether to direct the development of playtime interventions such as playground markings to target maintaining levels of activity, stimulate learning, social interactions, and creativity of young children, whilst ensuring not to limit their opportunities for physical activity.

Results are interesting in relation to all the children nearly reaching the recommended levels of activity during the school day, leading to question whether to omit the value for light

activity or to increase the recommendation alongside the aim to increase children's physical activity levels. Further study into the feasibility of this in relation to the national guidelines for physical activity for young children is recommended, taking into consideration additional activity that is undertaken in the home environment or after schools clubs for example.

5.6 Participant Age and Physical Activity

Results showed there was no significance for age in relation to physical activity between schools ($p>0.05$), however there was a clear interaction for moderate and light activity at school A. This interaction was attributed to the age of the participant in relation to activity levels (as shown in figures 6 and 7). Therefore, even though not proving statistically significant, age can be considered an important factor when considering levels of moderate and light activity, as the difference between 3 and 5 year old participants may have an influence on the intensity of activity participated in. This finding is supported by Pate *et al.,* (2008: 443) whose study results showed that 'younger children (3 year olds) spent less time in sedentary activities and more time in light MVPA, and VPA compared to older children (4 and 5-year-olds)', concurring with the present study's findings and also the justification for utilising age defined accelerometer cut-points (Sallis *et al.,* 2000).

Pate *et al.,* (2008) discuss that this change in physical activity can be attributed to the theory that as children's lives become more structured and they begin to engage in more pre-academic and classroom activities this begins to overshadow the typical free-play behaviours seen to be exhibited by younger children. This theory shows links with Piaget's theory of play behaviour (Lindon 2001) and the results found in the present study when considering child

age and their levels of activity. However evidence from the present study and literature is limited in reporting the type of activity children are engaging in and the activity levels specific to their age. This highlights a need for further investigation into this hypothesis and the direct links between age and young children's physical activity and play behaviours.

Even though School A did not prove statistically significant for physical activity intensities, further investigation showed that it is apparent (as shown in figure 5) that this interaction was not an ambiguity as it was also evident for activity levels across the whole school day (Table 9). A pattern is evident where the younger participants of School A engaged in more moderate activity and less light activity than any other school. This pattern was also evident for both boy and girl participants of School A (Tables 13 and 14). This finding is in contrast to the study conducted by Cardon *et al.,* (2009:338) who found that 'age had no significant effect on the activity engagement intensities and average activity level' of their study participants. However the children in the study were a mean age of 5.3 years (SD ±3 months) meaning the participants were older than within the present study (mean 4.6 years (SD ±7 months). The interaction apparent for school A (figure 5) in relation to physical activity suggests that children (3-4 years) engage in higher levels of moderate and light activity on the playground at baseline without the presence of the playground markings. This strikes further cause for investigation into the variance of play dynamics and activity levels of young children year-to-year, and even month to month at this early age, on the school playground to se at what stage children start shifting from lower levels of moderate activity to higher levels of light activity and the reasons behind this shift.

5.7 Participant Gender and Physical Activity

When considering the time participants spent in the different physical activity intensities the covariate of gender was not identified as having significance ($p>0.05$) for any activity intensity. This conflicts with a multitude of existing literature as highlighted in the literature review (Sallis *et al.,* 2000; Trost *et al.,* 2002a; Fabes *et al.,* 2003; Pate *et al.,* 2004; Ridgers *et al.,* 2006; Hinkley *et al.,* 2008; Cardon *et al.,* 2009; Stellino *et al.,* 2009) reporting physical activity amongst boys to be higher than girls within physical activity and play environments and findings recording boys to engage in less sedentary and inactive behaviours than girls.

> *'Observational studies of preschool-aged children have consistently demonstrated that boys play in larger groups and in more open settings, engage in more risk-taking behaviour, and play rougher games involving greater amounts of body contact than do girls'*
>
> (Pate *et al.,* 2004:1261)

A study conducted by Stratton and Mullan (2005) found that, pre and post a physically activity intervention, boys were more active than girls in the playground, however this findings were stated to be evident but not statistically significant ($p> 0.05$) and included children from 4-7 years of age. These findings of previous studies are contrary to those of the present study as boys and girls exhibited extremely similar patterns for engagement in sedentary, light, moderate and vigorous physical activity (Table 15). These converse findings on physical activity show that boys and girls may participate in different types of activity; however the activity levels are mirrored.

The finding that gender was not significant in relation to physical activity levels and inactive behaviours conflicts with the perceptions of the interviewees as the views on boys and girls play activities was predominantly gendered. None of the interview questions were specifically targeted to discuss gender in relation to child engagement in physical activity neither where the interviewees asked about their perceptions of female and male activities. However, multiple interviewees gave gendered answers asserting that boys are more active than girls in the playground;

> 'But the boys yeah they are running races, tig, stuck in the mud, anything like that' - DS01

This statement by interviewee DS01 mirrors the gendered perception stated by DS02:

> '...it is the girls that sit down and talk and make up games' - DS02

These stereotypical perceptions on young children's play reflect the post-structural feminist theory as outlined by Wood and Cook (2009) who assert that as agents of their being children begin to shape their gender identities at an early age (3-5 years) and express feminine and masculine powers through their play, such as boys playing rough and tumble play and girls engaging in more ordered activity. This also shows that those interviewed may have predisposed thoughts on the type of activities children engage in whilst in the playground. Consequently, this support Wood and Cook's (2009) ideas that adults inadvertently reinforce predisposed gender structures through not encouraging girls to be more adventurous in boisterous activities that are recognised to be masculine and vice-versa. However, even though theory and interviewee data report children to engage in gendered activities the present study shows no significant difference in the levels of physical activity engaged in by either gender and furthermore that that participants primarily

engaged in locomotor activities, including racing and chasing, running, skipping, jumping and hopping.

The majority of literature looking into children's play, physical activity and gender focuses more on older aged participants and general activities during playtimes and also outside of the school environment (Sallis *et al.,* 2000; Trost *et al.,* 2002). The views reported by interviewee responses and directing the discourse to gendered play activities in the present study could be attributed to individual perceptions of typical activities that boys and girls are associated with. The boys were generally pictured to be more physical and engaged in rough and tumble play in the school playground:

'I think that the boys are more active' - DS02

Whereas girls are associated with more calm and sedentary activities:

'There's still a couple of girls I would say that would sit out' - AS01

These ideas of gendered play activities within the non-gender coded environment of the playground, in relation activity intensities of the participants, are in contrast to the accelerometer data collected, however children still participated in various activities on the playground with only general activities recorded through observations (i.e. sedentary, game or locomotor) and therefore may participate in activities associated with activities associated being masculine and feminine.

This striking similarity in the participants' engagement in varying levels of physical activity irrespective of gender and the presence of playground markings generates ideas that the type of play participated in by boys and girls may well be diverse, however they still play at similar activity intensities. This suggests that further research should be conducted in establishing the types of activity boys and girls are likely to participate in, highlighting any differences and similarities and challenging the feminist and gender theories associated with play activity types and behaviours. As well as explore if the stereotypical perceptions of school staff are justified in relation to child gender, social groups and activities engaged in on the playground.

5.8 The Playground and Children's Play Behaviours

In relation to understanding the impact of playground markings on the dynamics of play the data shows no significance ($p>0.05$) between the schools and children's play behaviours. Therefore, the markings had no noted influence on play behaviours (play behaviours comprising of social interactions, group size and activity type).

From the contextual SOCARP data collected for the participants a picture of typical playground behaviours exhibited by children can be developed. Figure 8 depicts a model of the most frequent (mode) behaviours engaged in by the participants. Observations showed that typically young children play in small groups (2-4) (*mean* 71% of time), have limited physical or verbal social interactions (*mean* 62% of time making no social interactions) and predominantly engage in locomotor activity (running, skipping, and jumping) (*mean* 65% of

time). No other studies in this area have outlined Foundation Stage children's typical playground behaviours with figure 8 directly linking to study findings in Tables 17, 18 and 19 displaying SOCARP data. This model therefore casts light on young children's actions and activities. Ensuring other areas of discussion are taken into consideration, this model can consequently aid the development of age appropriate playground initiatives and directions for associated playground marking training for young leaders and playground supervisors in relation to this age bracket.

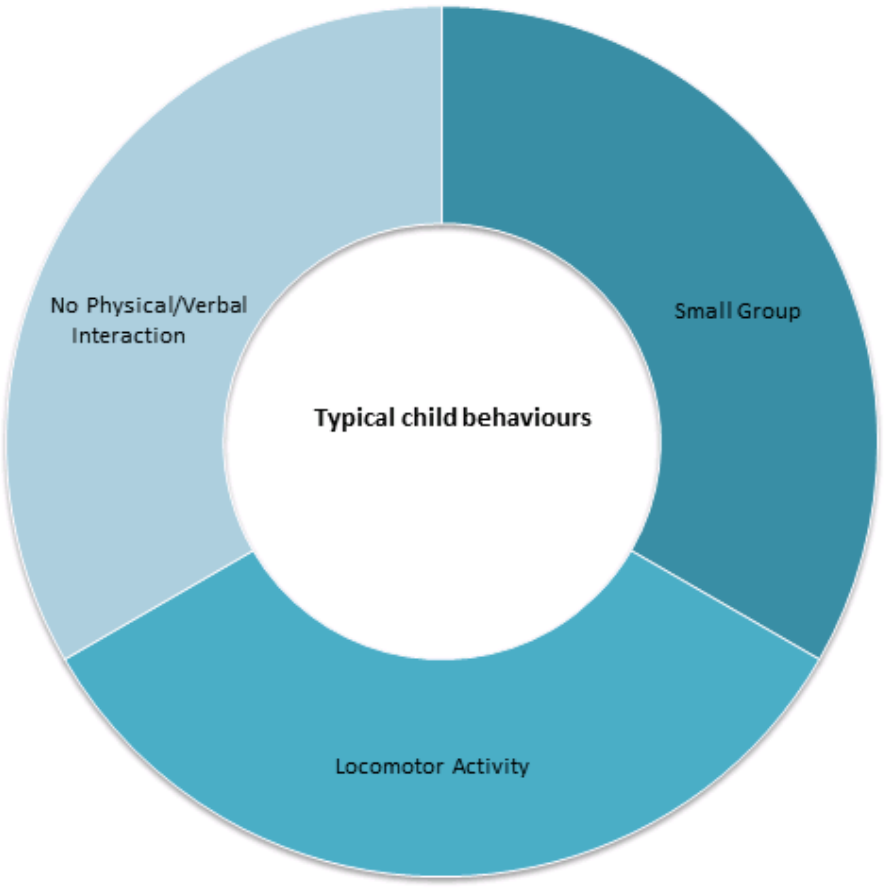


Figure 8: Model of children's most frequent playground behaviours

As outlined in chapter 5.3.3 evidence is contrary to the gendered perceptions that emerged from the interview data in showing that there was no significance ($p>0.05$) in behaviours between boys and girl participants. Boys and girls participated in very similar activity behaviours, irrespective of gender as outlined in Figure 8.

Typical child group interactions concurred with interview responses in the respect that children were reported to play in similar groups;

> 'I think they stick to mainly the same friendship groups unless they want to play something completely different' - DS02

However, even though this highlights that children did not generally play in isolation interview data did not specify the size of the groups. It is also highlighted by interviewee DS02 that child confidence, character and their friendships can affect their engagement in activities and their interactions with other children. The presence of other children within a play environment is also reported to be a stimulus for activity (Gubbles *et al.,* 2011).This reflects the present study's findings as, despite limited social interactions, children typically engaged in small groups on the school playground. This supports the ideas of Gubbles *et al.,* (2011) that opportunities for engaging with other children are an important aspect of the play environment. Therefore when considering the design of playground interventions and the use of playground markings, creating opportunities for children to play in small groups may be optimum. Therefore it is important to consider that the model shown in figure 8 is a

typical picture of child playground behaviours and different children may have different play preferences.

It is Interesting to note that children had few interactions with one another on the school playground, most frequently showing no physical or verbal social interactions with their peers and secondly positive verbal interactions (Table 19) but predominantly played in small groups. This reflects research by Coplan *et al.,* (2009) who report that young children (42-66 months) may show inhibited behaviours during free-play and engage in more dyadic play. This also reflects aspects Piaget's theory of play development (Lindon, 2001) as young children (under 5) are more ego-centric in their behaviour and learning to interact with other children; therefore playing in small groups but express themselves more through their actions than words.

5.9 The Ecology of the School Playground

The major themes of the interview data (Tables 25-28) combine to show an ecological picture of the perceived multidimensional nature of the playground for foundation school children from the perceptions of school staff. These areas; physical environment, social environment, child characteristics, perceptions of physical activity and the observed impact of markings, are portrayed in a dimensional model of perceptions of factors that influence the playground environment (Figure 9). This multidimensional model reflects the ideas of Sallis *et al.,* (2000:969):

> *'...youth physical activity is a complex behaviour determined by many factors. This result also supports ecological models of behaviour that pose behavioural influences from personal (biological, psychological, behavioural), social, and physical environmental factors'*

The ecology of children's physical activity and behaviour must be taken into consideration when designing playground interventions that target changes in children's behaviour, in this case the increasing the activity levels of foundation stage children.

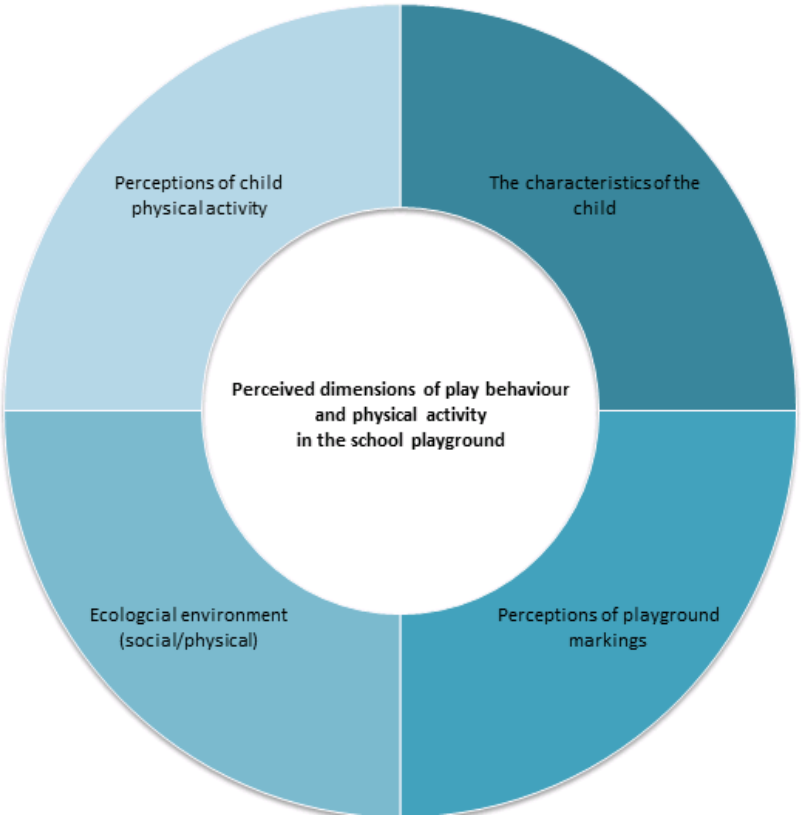


Figure 9: Model of the perceived dimensions of the play environment (physical activity, play behaviours and the impact of markings)

This therefore calls for future research to investigate if an optimum playground environment for foundation aged children can be developed, with interventions taking into consideration the ecology of the playground environment and this potential influence on the dynamics of young children's physical activity and play behaviours.

6. Conclusion

This study set out to identify if the installation of painted playground markings (multi-skill training zone package, see appendix figure 1) as part of a county-wide initiative had an impact on the physical activity levels of Foundation Stage children during playtime, in getting inactive children engaging in higher intensities of physical activity. Secondly the research aimed to ascertain how active Foundation Stage children are within the school playground and to what extent playtime contributes to children participating in the daily activity recommendation of 180 minutes of LMVPA. With the finally aim to cast light on the dynamics of young children's play behaviours within the school playground (activity types and social interactions) to determine if the installation of markings change to the type and frequency of play activities and social interactions of participants.

It is evident from bringing together findings from the three strand research design and the researcher being immersed in the school playground environment, that the installation of playground markings have no direct impact on the physical activity levels and play behaviours of foundation stage children. However, that is not say they are of no, or little, benefit. Interviewees stated that the children would utilise markings they saw value in, and knew how to use, such as hopscotch and snakes and ladders. This was supported in the perceptions of teachers, playground supervisors and teaching assistants that the associated playground training, as part of the 'multi-skills training package' for supervisors and young leaders, would be importance for instigating play and modelling games and maximising use of the markings. This would add value to play environment and teaching the children ways in which they can interact with the markings and continue to make their own free-play choices.

Evidence from the present study showed that younger participants engaged in more moderate and light activity, this generates questions on the effect of child development in relation to their age and links to activity levels and play dynamics. Taking into account theories of play development (Piaget's theory of play development) and child learning (Vygotskys theory of Zone of proximal development) it would be of interest to pursue further research into pinpointing at what age children begin to interact with their playground environment without the influence of older peers and adults and furthermore at what age children begin to become inactive; to consequently to direct and evidence the implementation of interventions to keep children active within the school playground.

Additionally, boys and girls activity levels were strikingly similar. A finding is contrary to a wealth of literature and also to the perceptions of the interviewees that embodied post-structural feminist ideas. Even though it was reported that gender was not a determinant of physical activity levels and both boys and girls mainly engage in locomotor activities, it was not determined if girls or boys typically partake in stereotypical masculine and feminine play. Playground markings had no significant effect on the social interactions and activity types of participants as recorded utilising the SOCARP observation tool. The SOCARP data meant a model could be created of typical participant behaviours within the school playground.

Playtime was highlighted to constitute to 22% of children's recommended daily activity levels, this a relatively high proportion in relation to the short period of the day spent in playtime (*mean* 61 minutes). Furthermore, children spent 38% of playtime in moderate-

vigorous activity. This therefore shows that children are active in the playground; however there is scope for engagement with the playground markings in relation to mixing use with young leaders and playground supervisors instigating playground games and activities. Across the whole school day children achieved ≥84% of the 180 minutes recommended activity guideline for children under 5 with the ability to walk. This figure is high when considering that the school day is typically 300 minutes, and proposed that further study focus on the guidelines to assess if they are realistic and also the inclusion of the light level of criteria.

This view of the playground as a whole environment, encompassing the physical and social elements in combination with the children's' characteristics supports the idea of the ecology of the playground environment. This needs to be recognised to create an optimum play setting for young children. The results from the present study suggest there is potential to create an optimum play environment through combining the development of the physical environment; markings, space, equipment and playground structures, with the training of supervisors and young leaders as part of the 'multi-skills training package' to prompt physical activity, this will inspire engagement and develop confidence through creative games and play whilst maintaining an emphasis on free-play activities.

The pragmatic nature of the study design allowed for the researcher to be reflexive throughout the study process, and assess elements of rigour, originality and study impact. No other study has looked into the impact of playground markings on the physical activity of Foundation Stage children utilising a multi-method research strategy. Furthermore, the

present study set out to explore not only the impact of an intervention aiming to get children more active within the playground but also the wider contextual elements of participant social interactions and the types of activity being engaged in. This is all supported by perceptions obtained from teachers, teaching assistants and playground supervisors who were key to providing information on the playground environment and an added element of rigour in results as spend a lot of time with the participants in question. Further reflexive commentary on the study outcomes, challenges and impact are highlighted in the subsequent chapters.

6.1 Study Limitations

The present study presented several limits in execution; these predominantly took the form of delimitations and aid in direction of ideas for future study. Firstly, the factor of child age could be questioned in relation to the number of participants included in the study. *Sallis et al.,* (2000) state that study sample size may have a direct bearing on likelihood of identifying statistically significant results. Therefore, an increased number of participant schools and child participants would also have increased the vigour of the study.

Body mass index (BMI) and anthropometric measures of the study participants were not made available by the participating schools. This data could have added vigour and greater insight into the physical activity behaviours of the participants on the playground. Furthermore, it could then have been determined if child body mass was an influencing factor on foundation age, activity levels and play behaviours; as high levels of BMI have been associated with lower levels of physical activity and vice-versa (Jago *et al.,* 2005; Graf *et al.,* 2004; Pate *et al.,* 2004). BMI information could also have allowed for calculation of energy expenditure adding another dimension to the study results.

As the playground markings were already installed into schools C and D it was not possible to get the baseline measurements for activity for each group and therefore a match paired study design was utilised instead of a pre and post intervention study.

The accelerometer cut-points utilised in the study to determine the participants activity levels were those established by Sirard *et al.,* (2006). To add validity to the study, specific cut points were attempted to be taken for each school. This protocol involved the children participating in activities that constituted to being in sedentary, light, moderate and vigorous activity as highlighted in the child activity rating scale (CARS). A calibration activity was conducted on the first day of each data collection period within each school, so as not to clash with the following 4 days of results as the first day data was omitted from the study. The levels were recorded by accelerometers and aimed to allow for child specific activity cut-points to be calibrated. Therefore cut-points would be specific to each participant and a truer picture of their activity levels would have been able to be determined. However this was unsuccessful due to child attrition in activities whilst capturing cut points at different activity levels. The calibration activities were recorded using a single researcher and the capturing of accelerometer data. It would have been of benefit to have multiple researchers present to minimise attrition from the activities and also to record the calibration activity sessions. To eliminate participants not engaging in the correct activity and to support the findings for calibration cut points. Further study into establishing evidenced age specific calibration cut-points for the actigraph accelerometer is recommended.

The review of literature deduced that both measurement tools, SOCARP (Welk, 2002; Ridgers *et al.,* 2008; Ridgers *et al., 2010)* and accelerometers (Sirard *et al.,* 2006; Cardon *et al.,* 2009; Oliver *et al*, 2009; Basset Jr and John, 2010; Sherar *et al.,* 2011) were reliable for measuring physical activity and that the accelerometer recordings would potentially support the SOCARP data. Study findings evidence that the accelerometer data collected did not

match the SOCARP recordings and therefore questions the tool in respect of measuring physical activity intensity for young children. This led the researcher to question the robustness of each quantitative method concluding that categories defining child activity levels are limited in regards to spectrums of movement in SOCARP. The activity measurements consist of lying down, sitting, standing, walking and vigorous/very active activity. Consequently, there is an evident jump from walking to vigorous activity.

From utilising the tool in the field and comparing to objective measures, the SOCARP tool is not a clear comprehensive measure of activity in relation to the actual activity the target child is participating in and the intensity that is recorded. The SOCARP Description and Procedures Manual Version 2.0 (Ridgers *et al.,* 2008) states that vigorous activity is anything 'that requires the child to expend more energy than he/she would for an ordinary walk'; this statement is subjective to the researchers perceptions of what constitutes to anything above any given child's 'ordinary walk'. Furthermore, the coding protocol and guidance may prove difficult to for the observer to interpret when faced with recording specific activities such as, repetitive limb movement, climbing, throwing and stationary but vigorous activity like jumping jacks or hopping. Therefore the accelerometer data was utilised as the primary results for participant physical activity.

Utilising a multiple method research design is also not without its challenges. As highlighted with the SOCARP and accelerometer data for physical activity researchers run the risk of results not agreeing and having to work with contradicting sets of data (Cresswell and Plano Clark, 2011). Furthermore, as explained in the waiting equal weighting was given to each

method utilised and therefore the researcher had to justify the use of the accelerometer data over the SOCARP findings.

6.2 Directions for Future Research

Multiple directions for future research have been highlighted throughout the study discussion. The varied nature of young children's physical activity, play and the dynamics of their behaviour in relation to the playground and an intervention aiming to increase levels of physical activity amongst inactive children mean that a plethora of avenues exist to add to knowledge to the field, these fall under two areas which comprise of 1) Physical activity and measure and 2) The play environment.

Ideas for further study in relation to the subject area, physical activity and measures include:

- Exploring the links between young children's year-to-year age physical activity and play dynamics, taking into consideration anthropometric measures

- Investigation into the gendered perceptions of boys and girls and the different types of activities participated in on the playground

- Early year's children's physical activity throughout the day in relation to the guidelines of 180 minutes of activity and implications for the current recommendations

- Further investigation into the reliability of SOCARP as a measure for observing child physical activity levels

- Study into establishing evidence based age specific calibration cut-points for the actigraph accelerometer

Future directions for research into the playground environment:

- The impact of the multi-skill zone training on the use of playground markings as a tool to promote physical activity

- The impact of structured vs. unstructured play environments on physical activity levels and child development

- Investigation into the theory of an optimum playground environment for foundation stage children utilising the model as outline in Figure 9

7. References

Almqvist, L., Hellnas, P., Steffanson, M. & Granlund, M. (2006) 'I can play!' Young children's perceptions of health. *Pediatric Rehabilitation.* 9 (3), 275-284.

Basset Jr, D, R. & John, D. (2010) Use of pedometers and accelerometers in clinical populations: validity and reliability issues. *Physical Therapy Reviews*. 15 (3), 135-142.

Bazeley, P. (2009) Analysing Qualitative Data: More Than 'Identifying Themes'. *Malaysian Journal of Qualitative Research*. 2, 6-22.

Bjorklund, D, F. & Brown, R, D. (1998) Physical play and cognitive development: Integrating activity, cognition and education. *Child Development*. 69, 604-606.

Blaes, A., Ridgers, N. D., Aucouterurier, J., Van Praagh, E., Berthroin, S. & Baquet, G. (2013) Effects of a playground marking intervention on school recess physical activity in French children. *Preventive Medicine.* In Press.

Bornstein D, B., Beets, M,W., Byun, W, & McIver, K. (2011) Accelerometer-derived physical activity levels of pre-schoolers: A meta-analysis. *Journal of Science and Medicine in Sport.* 14, 504-511.

Boulton, M, J. (1999) Concurrent and longitudinal relations between children's playground behaviour and social preference, victimization, and bullying. *Child Development*. 70 (4), 944-954.

Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*. 3, 77-101.

British Heart Foundation (2012). *Sedentary behaviour: evidence briefing*. Loughborough UK: British Heart Foundation National Centre (BHFNC) for Physical Activity and Health.

Brockman, R., Jago, R. & Fox, K, R. (2011) Children's active play: self-reported motivators, barriers and facilitators. *BMC Public Health*. 11, 461-468.

Brown, W, H., Pfeiffer, K, A., McIver, K, L., Dowda, M., Almeida, M., Joao C, A. & Pate, R, R. (2006) Assessing Preschool Children's Physical Activity. *Research Quarterly for Exercise and Sport*. 77 (2), 167-176.

Brown, W, H., Pfeiffer, K, A., McIver, K, L., Dowda, M., Addy, C, L. & Pate, R, R. (2009) Social and Environmental Factors Associated with Preschoolers' Non-sedentary Physical Activity. *Child Development.* 80 (1), 45-58.

Brown, T. & Summerbell, C. (2009) Systematic review of school-based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. *Obesity Review*. 10 (1), 110-141.

Brustad, R, J. (1993) Who will go out and play? Parental and psychological influences on children's attraction to physical activity. *Pediatric Science*. 5, 210-223.

Bundy, A, C., Luckett. T., Tranter, P, J., Naughton, G, A., Wyver, S, R., Ragen, J. & Spies, G. (2009) The risk is that there is 'no risk': a simple, innovative intervention to increase children's activity levels. *International Journal of Early Years Education.* 17 (1). 33-45.

Burdette, H, L. & Whitaker, R, C. (2005) Resurrecting free play in young children: Looking beyond fitness and fatness to attention, affiliation, and affect. *Pediatric Adolescent Medicine*. 159 (1), 46-50.

Cardon, G., Van Cauwenbeghe, E., Labarque, V., Haerens, L. & De Boureaudhuij, I, M, M. (2008) The contribution of preschool playground factors in explaining children's physical activity during recess. *International Journal of Behavioural Nutrition and Physical Activity.* 5 (11), 5-17.

Cardon, G. & De Boureaudhuij, I, M, M. (2008) Are preschool children active enough? Objectively measured physical activity levels. *Research Quarterly for exercise and Sport.* 79 (3), 326-332.

Cardon, G., Labarque, V., Smits, D. & De Bourdeaudhuij, I, M, M. (2009) Promoting physical activity at the pre-school playground: The effects of providing markings and play equipment. *Preventive Medicine*. 48, 335-340.

Coplan, R. J., DeBow, A., Schneider, B, H. & Graham, A, A. (2009) The social behaviours of inhibited children in and out of preschool. *Journal of Development Psychology*. 27, 891-905.

Chief Medical Officers. (2011) Stay Active, Start Active: A report on physical activity for health from the four home countries' Chief Medical Officers. London UK: Department of Health, Physical Activity, Health Improvement and Protection.

Cresswell, J, W (2003) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. London UK: SAGE Publications. 2nd edition.

Cresswell, J, W and Plano Clark, V, L. (2011) Choosing a mixed method design. In: Cresswell, J, W. *Designing and Conducting Mixed Methods Research*. London UK: SAGE Publications. 54-106.

Cresswell, J, W. (2011) Controversies in mixed methods research. In: Dezin, N, K and Lincoln, Y, S. *The Sage Handbook of Qualitative research*. London UK: SAGE Publications. 269-283.

Department of Health (2004) *At least five a week: Evidence on the impact of physical activity and its relationship to health*. London UK: British Nutrition Foundation.

Ebbeling, C, B., Pawlak, D, B. & Ludwig, D, S. (2002) Childhood obesity: public-health crisis, common sense cure. *The Lancet*. 360 (1), 473-482.

Fabes, R, A., Hanish, L, D. & Martin, C, L. (2003) Children at Play: The Role of Peers in Understanding the Effects of Child Care. *Child Development*. 74 (4), 1039-1043.

Graf, C., Koch, B., Kretchmann-Kandel, E., Falkowski, G., Christ, H., Coburger, S., Lehmacher, W., Bjarnason-Wehrens, B., Platen, P., Towarski, W., Predel, H, G. & Dordel, S. (2004) Correlation between BMI, leisure habits and motor abilities in childhood (CHILT-Project). *International Journal of Obesity*. 28, 22-26.

Hands, B., Parker, H. & Larkin, D. (2006) Physical activity measurement methods for young children: A comparative study. *Measurement in physical duration and exercise science*. 10 (3), 203-214.

Hannon, J, C. & Brown B, B. (2008) Increasing preschoolers physical activity intensities: an activity-friendly preschool playground intervention. *Preventive Medicine.* 46, 532-536.

Health Promotion Wales. (1997) The health promoting playground project: evaluation findings. *Research Summary 1997*. Cardiff UK.

Hinkley, T. Crawford, D. Salmon, J. Okely, A, D. & Hesketh, K. (2008). Preschool Children and Physical Activity: A review of Correlates. *American Journal of Preventive Medicine*. 34 (5), 435-441.

Jago, R., Baranowski, T., Baranowski, J, C., Thompson, D. & Greaves, K, A. (2005) BMI from 3-6 years of age is predicted by TV viewing and physical activity, not diet. *International Journal of Obesity*. 29, 557-565.

Janssen, M., Toussaint, H, M., Willem, M, V. & Verhagen, E. (2011) PLAYgrounds: Effect of a PE playground program in Primary Schools on PA levels during recess in 6 to 12 year old children. Design of a prospective controlled trial. *BMC Public Health*. 8 (11), 282-296.

Lindon, J. (2001*) Understanding Children's Play*. Cheltenham UK: Nelson Thornes

Lobstein, T., Baur, L. & Uauy, R. (2004) Obesity in children and young people: a crisis in public health. *The International Association for the Study of Obesity*. 5 (1), 470-478.

Loprinzi, P, D. & Cardinal, B, J. (2011) Measuring children's physical activity and sedentary behaviours. *Journal of Exercise science and Fitness*. 9 (1), 15-23.

Malina, R, M. (1996) Tracking of physical activity and physical fitness across the lifespan. *Research Quarterly for Exercise and Sport*. 67, 48-57.

Mackenzie, N. & Knipe, S. (2006) Research dilemmas: Paradigms, methods and methodology. *Issues in Educational Research*, 16 (2), 193-205.

McKenzie, T, L., Crespo, N, C., Baquero, B. & Elder, J, P. (2010) Leisure-time Physical Activity in Elementary School: Analysis of contextual conditions. *Journal of School Health.* 80 (10), 470-477.

Mitchell, M, L. & Jolley, J, M. (2012) *Research Design Explained*., California : Cengage Learning. 8th Edition

Morse, J, M., Niehaus,L., Wolfe, R, R and Wilkins, S. (2006) The role of theoretical drive in maintaining validity in mixed-method research. Q*ualitative research in psychology*. 3, 279-291.

National Association for Sport and Physical Education. (2002) *Position Paper. Guidelines for After School Physical Activity and Intramural Sports Programs*. Vancouver, USA: Reston.

Nilsson, A., Ekelundm, U., Yngve, A. & Sjostrom, M. (2002) Activity among children with accelerometers using different time sampling intervals and placements. *Pediatric Exercise Science*. 14, 87-96.

Nielson, G., Bugge, A., Hermansen, B., Svensson, J. & Bo Anderson, L. (2012) School playground facilities as a determinant of children's daily activity: A cross-sectional study of Danish Primary School children. *Journal of Physical Activity and Health*. 9, 104-114.

Oliver, M., Schofield, G. M. & Kolt, G. S. (2007) Physical activity in preschoolers. *Sports Medicine*. 37 (12), 1045-1070.

Oliver, M., Schofield, G, M. & Schluter, P, J. (2009) Accelerometry to assess preschooler's free-play: Issues with count thresholds and epoch durations. *Measurement in Physical Education and Exercise Science*. 13, 181-190.

Pate, R., Baranowski, T., Dowda, M. & Trost, S, G. (1996) Tracking of physical activity in young children. M*edicine and Science in Sports and Exercise*, 28, 92-96.

Pate, R, R., Pfeiffer, K, A., Trost, S, G. Ziegler, P & Dowda, M. (2004) Physical activity among children attending preschools. *Pediatrics*. 114 (5), 1258-1263.

Pate, R, R., McIve, K., Dowda, M., Brown, W, H. & Addy, C. (2008) Directly observed physical activity levels in preschool children. *American School Health Association*. 78 (8), 438-444.

Pate, R, R., O'Neill J, R. & Lobelo, F. (2008) The evolving definition of "sedentary". *Exercise and Sport Sciences Reviews*. 36 (4), 173-178.

Pica, R. (2003) *Your Active Child: how to boost physical, emotional, and cognitive development through age-appropriate activity.* Chicago USA: Contemporary Books.

Puhl, J., Greaves, K., Hoyt, M. & Baranowski, T. (1990) Children's activity rating scale: description and calibration. *Research Quarterly for Exercise and Sport*. 60, 42-47.

Ramstetter, C, L., Murray, R. & Garner, A, S. (2009) The crucial role of recess in schools. *Journal of School Health*. 80 (11), 517-526.

Rink, J., E; Hall, T, J. & Williams, L, H. (2010). *Children's play and physical activity*. Leeds UK: Human Kinetics. 6th edition.

Ridgers, N., Stratton, G. & Fairclough, S, J. (2006) Physical activity levels of children during school playtime. *Sports Medicine*. 36 (4), 359-371.

Ridgers, N, D., Stratton, G., Fairclough, S, J. & Twisk, J,W (2007) Long-term effects of a playground markings and physical structures on children's recess physical activity levels. *Preventive Medicine.* 44 (5), 393-397.

Ridgers, N, D., Stratton, G. & McKenzie, T, L. (2010) Reliability and validity of the System for Observing Children's Activity and Relationships during Play (SOCARP). *Journal of Physical Activity and Health*. 7 (1), 17-25.

Rink, J, E., Hall, T, J. & Williams, L, H. (2010) *Children's play and physical activity*. Leeds UK: Human Kinetics. 6th edition.

Reilly, J, J. & Dorosty, A, R. (1999) Epidemic of obesity in UK children. *Lancet*. 354 (27), 1874-875.

Sallis, J, F., Prochaska, J, J. & Taylor, W, C. (2000) A review correlates of physical activity of children and adolescents. *Medicine & Science in Sports and Exercise*. 32 (5), 963-975.

Sherar, L, B., Griew, P., Esliger, D, W., Cooper, A, R., Ekelund, U., Judge, K. & Riddoch, C. (2011) International children's accelerometry database (ICAD): Design and methods. *BMC Public Health*. 11, 485-525.

Shumaker, S, A., Ockene, J, K. & Riekert, K, A. (2009) *The Handbook of Health Behavior Change.* New York USA: Springer. 3rd edition.

Singh A, S., Mulder, C., Twisk, J, W, R., Van Mechelen W. & Chinapaw M, J, M. (2008) Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obesity Reviews*. 9, 474-488.

Smith, P, K. (2010) *Play: Encyclopaedia on early childhood development*. London UK: Goldsmiths University of London.

Stellino, M, B., Sinclair, C, D., Partridge, J, A. & King, K, M. (2010) Differences in children's recess physical activity: Recess activity of the week intervention. *Journal of School Health*. 80 (9), 436-444.

Stratton, G. (2000) Promoting children's physical activity in primary school: An intervention study using playground markings. *Ergonomics.* 43 (10), 1538-1546.

Stratton, G., & Leonard, J. (2002) The effects of playground markings on the energy expenditure of 5 – 7-year-old school children. *Pediatric Exercise Science*. 14, 170 – 180.

Stratton, G. & Mullan, E. (2005) The effect of multicolor playground markings on children's physical activity level during recess. *Preventive Medicine*. 4 (1), 821-833.

Tannock, M. (2011) Observing young children's rough and tumble play. *Australasian Journal of Early Childhood.* 36 (2), 13-20.

Titman, W. & McGill, I. (1992) *Play, Playtime and Playgrounds: Key issues for teachers, supervisors and governors of primary schools*. London, UK: WWF/Learning through Landscapes

Torpy, J, M.. (2010) Chronic diseases of children. *The Journal of the American Medical Association*. 303 (7), 682.

Trost, S, G., Ward, D, S., McGraw, B. & Pate, R, R. (2002) Validity of the previous day physical activity recall (PDPAR) in fifth-grade children . *Pediatric Exercise Science*. 11, 341-348.

Trost, S G., Pate, R,R., Sallis, J,F., Freedson, P,S., Taylor, W,C., Dowda, M., & Sirard, J. (2002a) Age and gender differences in objectively measured physical activity in youth.. *Medicine and Science in Sports and Exercise*. 34 (2), 350-355.

Trost, S, G., McIver, K, L. & Pate, R, R. (2005) Conducting accelerometer-based activity assessments in field-based research. *Medicine and Science in Sports and Exercise*. 37, 531-543.

Ward, D, S., Saunders, R, P. & Pate, R, R. (2007). *Physical activity interventions in children and adolescents*. Leeds: Human Kinetics. 11th edition.

Welk, G, J., Corbin, C.B. & Dale, D. (2000) Measurement issues in the assessment of physical activity in children. *Research Quarterly in Exercise and Sport*. 71 (2), 59-73.

Westerterp, K, R. (1999) Physical activity assessment with accelerometers. *International Journal of Obesity*. 23 (3), 45-49.

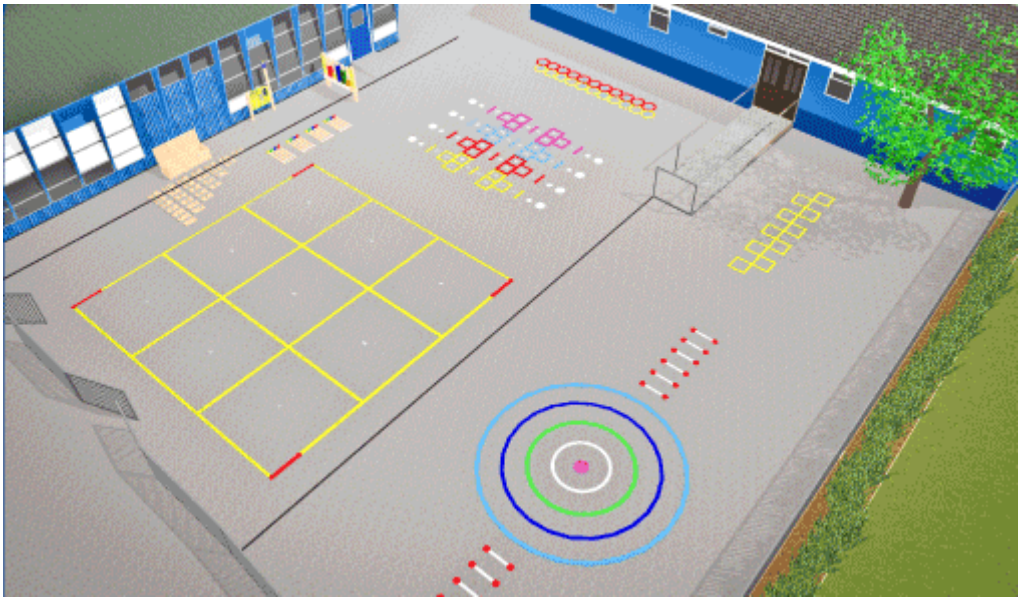
Wood, E & Cook, J. (2009). Gendered discourses and practices in role play activities: A case study of young children in the English Foundation Stage. *Educational and Child Psychology*. 26 (2), 19-30.

Yelland, N. (2011) Reconceptualising Play and Learning in the lives of Young Children. *Australasian Journal of Early Childhood*. 36 (2), 4-12.

Zastrow, C, H. & Kirst-Ashman, K, K (2010) Understanding Human Behaviour and the Social Environment. Brooks/Cole, California USA.

8. Appendices

Appendix 1: Multi-skill training Zone



Appendix 2: Breakdown of interviewee role by school

School	Interviewee Number	Interviewee Role
A	AS01	Class Teaching Assistant
	AS02	Class Teacher
B	BS01	Playground Supervisor
	BS02	Class Teacher
C	CS01	Class Teaching Assistant
	CS02	Class Teaching Assistant
D	DS01	Class Teaching Assistant/Playground Supervisor
	DS02	Class Teacher

Appendix 3: Interview questions – schools with markings

A study to determine the impact of playground markings on physical activity and play behavior of foundation level pupils

Interview Questions and protocol – Playground Markings

Before the interview is conducted can you please state your role within the school?

1. Teachers'/Teaching Assistants'/Playground Supervisors' Experience

a. In your experience how do children spend their playtime?
b. What is your involvement during these times?
c. In your opinion are there groups of pupils who are more or less active during these times?
d. Currently what activities do pupils take part in at playtimes?
e. In your opinion how active are your pupils at playtime?
f. In your opinion what (if anything) affect the children's play behaviours?
g. In your opinion what (if anything) affects the children's play activities?

2. Expectations

a. What is your view on the installation of playground markings into your school?
b. How do you think the pupils have reacted to the markings?
c. Do you think the think the markings have had an impact on the activity levels of your pupils? (short term and long term)
d. What have you gained from the playground training that accompanied the installation of the markings?

3. Current School Arrangements

a. Apart from the markings, is there currently any provision, during playtimes, to engage pupils in activity?
b. Are pupils encouraged to be active in playtimes and can you give any examples?

4. Any Other Comments?

Appendix 4: Interview Questions – schools without markings

A study to determine the impact of playground markings on physical activity and play behavior of foundation level pupils

Interview Questions and protocol – No Playground Markings

Before the interview is conducted can you please state your role within the school?

1. Teachers'/Teaching Assistants'/Playground Supervisors' Experience

a. In your experience how do children spend their playtime?
b. What is your involvement during these times?
c. In your opinion are there groups of pupils who are more or less active during these times?
d. Currently what activities do pupils take part in at playtimes?
e. In your opinion how active are your pupils at playtime?
f. In your opinion what (if anything) affect the children's play behaviours?
g. In your opinion what (if anything) affects the children's play activities?

2. Expectations

a. What is your view on the installation of playground markings into your school?
b. How do you think the pupils would react?
c. Do you think the think the markings would have an impact on the activity levels of your pupils? (short term and long term impact)
d. What would you hope to gain from playground training that would accompany the installation of markings?

3. Current School Arrangements

a. Is there currently any provision, during playtimes, to engage pupils in activity?
b. Are pupils encouraged to be active in playtimes and can you give any examples?

4. Any Other Comments?

Appendix 5: Interview Transcript – School A – Participant AS01

Date: 11.11.11

First Question is really about your experiences of children playing in the playground, so in your experience how do children spend their playtime? How would you sum it up?

AS01: At the top end, out of the older year sixes they would just play football. And the girls would just stand around talking, they've got to that age where, well there's not really anything in the playground, you've seen the playground, and there's nothing really for them to do is there?

So talking about these guys [foundation pupils]?

AS01: Oh these guys, well at playtime they just run around normally after they've had tuck, then in the afternoon play it's just with little balls and things.

What is your involvement during playtime?

AS01: Run around (laughs)… we'll play chase or tig or just running around playing with them, trying to keep them entertained really, there's nothing for them this is there? There's nothing really.

Yeah just a blank canvas. In your opinion are there groups of pupils who are more or less active during playtime?

AS01: Yeah, definitely. You have, well up until this week we had a couple that would just sit on the wall. 'Cus they are shy or because the… well just genuinely don't want to run around

bless them. But there's still a couple of girls I would say that would sit out, unless you got them involved in running round and holding their hands and literally running round with them.

OK, what activities do pupils take part in during playtime?

AS01: At dinner time the dinner ladies do take things out don't they, like hoppers and things like that

In your opinion how active would you say the pupils are?

AS01: I'd say they could be more active. I mean they take about ten minutes eating their tuck don't they? So they've only got like a short playtime, I think they could be more active, I don't think they are that active to be fair.

OK, in your opinion what if anything would affect the children's kind of play behaviours and the activities that they do?

AS01: well I think personally we could have like at certain schools they have play equipment like climbing frames, different things to walk on, but we haven't got anything. Even hopscotch or something like that, do you know what I mean. Yeah anything that they could just do rather than just running round, 'cus they can only run around or play tig can't they? There's nothing there. Anything.

What are your views or what would your views be on the installation of playground markings into your playground?

AS01: Yeah I think that would be good, 'cus that's what we used to have when we was younger at school and I think it's good. I mean it's better than just having nothing isn't it? We have absolutely nothing at the minute.

How do you think the children would react to the playground markings?

AS01: I think they'd enjoy it, it would be something new and they could do other things rather than just running round couldn't they. The boys as well cus the boys like tend to do things as well, but especially the girls, they would really enjoy it, things like hopscotch.

Do you think the markings would have an impact on short term and the long term?

AS01: I think they would, cus it's giving them more options, like the running round, they've got more things that they could be doing. I think it would, yeah definitely.

With the installation of the playground markings, alongside there is training for supervisors to play lots of games for the children to do and encourage them to use the markings , what do you think you would be able to gain from doing this kind of training?

AS01: Well you would interact more with the children and play with them more and, I don't know you would just know what to do with them rather than… I know with the older ones… with the little ones you get more involved and join in couldn't you. If you had the training or whatever it is to go with it...

Do you think it would be really beneficial if they did that?

AS01: Yeah definitely.

Is there currently any provision during playtime to engage the pupils in activities

AS01: More from my point of view? Sometimes yeah we do like games and run around and join in with them, but there's not really anything to play with apart from playing tig and stuff like that. The afternoons we will play ball with them or catching or something like that. But that's it really. They've got really nothing to be fair, we just play tig and things with them.

Yeah, I've seen them try to play hide and seek, but there's nowhere to hide!

ASO1: it's a bit better when the mobiles weren't there, as that was the little ones playground, and there was when my daughter was here in reception like, there were markings that they could follow and things like that, just faded with time.

Appendix 6: Interview Transcript – School A – Participant AS02

Date: 11.11.11

Okay, so to start with, in your experience how do the children spend their playtime?

AS02: Well in the morning, morning play to begin with they eat their tuck so they are sitting down to begin with and the routine you know, they don't get up and run until they have finished everything [morning snack]. And then racing and chasing I think probably, sometimes if we have been doing ring games in PE some of them will set up and to ring games themselves. Sometimes the staff will go over and do games with them.

What is your involvement during these playtimes would you say?

AS02: I try and get involved as much with the children as I can and try to keep an eye on them at the same time. We have one person at the steps to make sure no one runs off to the toilet without asking, so we can keep tabs on everything. I just like running around with them basically and just making sure everyone's safe.

In your opinion do you think there are pupils that are more or less active than others?

AS02: definitely, you definitely have your observers, you definitely have the children that will sit and eat their tuck very slowly and watch what all the other children are doing, like little [Foundation Stage Pupil], but the boys they're really off and active, some of them like [Foundation Stage Pupil] like an adult with her when they are running around.

What activities do you think the pupils mostly participate in during playtime? Is it mostly chasing?

AS02: Mostly chasing. When we have the equipment out, in the afternoon when we tend to take the equipment out, there's more ball skills and sharing. When we had the equipment out in the morning we tend to find children weren't eating they're snack, apples with just one bite taken out and thrown in the bin so that they could go off and play.

How active would you say everybody is at playtime?

AS02: children? Staff? Or...?

The children.

AS02: The children, I would say the majority of them are up and active, I would say the majority. I would say the boys especially are the fastest racers around.

Do you think if anything, what affects the children's, play behaviours and activities that they get involved with?

AS02: sometimes when you get the equipment out, the balls for example, there's a particular ball, with a face on it, that's very bouncy, and they all go for that one particular ball, and then you have issues of sharing and turn taking, so you have issues with that. Mostly they tend to get along quite nicely with each other; they sometimes get a bit rough during tig when they're pushing rather than tigging.

Do you think having the playground supervisors and getting involved with them makes a big difference in how active they are?

AS02: I certainly like running around and playing with them, because if you have a member of staff who's stationary and standing around, a child knows that they can go to the far corner and the teacher is not able to get to them if they do something, whereas if I'm

running round I could be in that far corner at any second. Do you see what I mean? There's no hiding place if I'm moving round with them.

Moving on to talking a bit about playground markings, what is your view on installing playground markings in your school?

AS02: I think it would make the playground look more inviting, it would enable us to use the playground more for a learning space, I think it would make the playground look like it was a bit more cared for to be honest.

How do you think the pupils would react?

AS02: I think they would be really excited.

Do you think that would be a short term effect or long-term impact?

AS02: I think it would be a bit of a novelty at first. I think it would be quite short term, but then it would be up to the staff to utilise the markings to make it happen. When we take the chalks out we do draw hopscotch and things but it's very sort of oldie worldy.

The company that is installing markings into playgrounds in Lincolnshire at the minute, alongside that they do staff training to teach the staff games that they could use, do you think that that would be beneficial, and you could gain from that?

AS02: Definitely [use playground marking training], the dinner ladies involved as well so it's not just the staff during the day but kids club staff as well

Just to round off, is there currently much provision during play time to engage pupils and are they encouraged to be active at play times?

AS02: When I'm running round like a mad woman, they tend to follow and chase, yeah we encourage them to be active, because it's their chance to be active in a large space.

Appendix 7: Interview Transcript – School B – Participant BS01

Date: 09.12.11

In your experience how to children spend their playtime? What kind of activities?

BS01: Running around, skipping, chasing each other.

What is your involvement during playtimes?

BS01: to organise lunchtimes, make sure there is enough equipment out

To organise activities and things like that?

BS01: yeah

In your opinion do you think there are groups of pupils who are more or less active during playtime?

BS01: I think it's 50/50, some of the children just like to do their own thing and some of the children like play with the elder children like different activities, and it's a big variety I like to think. I like to think it's a good variety.

Currently what activities do pupils partake in playtime?

BS01: there's a colouring club that children can go to. Then after Christmas they've got hula hoops, connect four, jenga, Frisbee, footballs, tag rugby, some of the summer games as well. A good variety.

Once playground markings are put in do you think it will make much difference to activities, and how active they are out there already?

BS01: It depends what markings they put down. We used to have giant snakes and ladders that they all played round and they did love that, but it all depends what they put down, and then what the children do, that will be their own thing.

Do you think the pupils are very active at playtime?

BS01: They are, most of them are [active].

What if anything do you think, affects the amount that the children play?

BS01: Weather, weather definitely. Windy day they don't want to be outside, rainy days they want to be inside. Sunny days, they might, but sit in the shade. It depends on the weather.

So weather is a big factor?

BS01: On wet days, when it's throwing it down we're in, we do have the backup.

What is your view on the installation of playground markings? Will it be a good thing?

BS01: I think it will be [a good thing], going on past experience. It will depend on the children really. We can't force them to go and play on them. As long as they are outside getting some fresh air I'm quite happy with that.

How do you think, when they are put in? Children will react?

BS01: They will be excited, overwhelmed, it will be a novelty, everyone will want to play on them and then they will be back to what they were doing before.

That was my next question; do you think they will have a short-term impact or long-term impact?

BS01: I think that it will be short term. But then again you get the select few that like doing the same things over and over again so I think it depends on what they want to do.

Their choice, their free playtime?

BS01: yes [playtime is their free choice], it's about keeping them in a safe environment.

The company that is installing the markings is giving training alongside it to supervisors about the different games that can be played, and how to encourage the children to use them. Do you think that would be a good thing?

BS01: yeah, sometimes the children want the adults to play with them. You could teach that to the children and then they can take that on and then the adult can take a step back again.

Is there currently any provision at playtime to engage pupils in physical activity? And getting the kids active at playtime?

BS01: Yes, when we have equipment out there, skipping ropes you name it.

Are the children encouraged to be active?

BS01: Yes we like to get them running around, out in the air.

Can you give any examples?

BS01: Skipping, football, tag rugby, you name it we have got it. It's a reward as well; if they are behaving and they are being good then it's their treat to have equipment out.

You have play leaders as well on the playground; do you think that makes a difference?

BS01: yes it does [make a difference to have playground leaders], sometimes we have 8 play leaders, who will be on the playground generally being a helping hand to staff.

Appendix 8: Interview Transcript – School B – Participant BS02

Date: 09.12.11

First question is quite broad. In your experience how do you think the children spend their playtimes? What activities do they do?

BS02: The boys tend to run fast any games that involve being active, without gender stereotyping, some of the girls within the class often ask to take out paper and pens, and that the kind of thing they like. Some children always rely on the same friends and will play similar games, whether that be one they are making up based on their favourite TV program or tig and catch, and then there are others who are social butterflies and see what comes their way. They will see other children playing a game and go and join in. Lots of boys playing aliens, Ben 10. Because they don't have the equipment maybe their imaginations run.

What is your involvement at playtime?

BS01: At this time of year when it's raining you have children fall over a lot, bumps and tumbles, but mainly at this age helping them with their social skills, taking turns, sharing, making sure everyone is included. That tends to be in key stage 1 a big part of it as they would bicker and someone would be left out. When we did have play equipment we would model how to use it. So when we get that they will use it more. But at the moment making sure everyone is happy and being involved in active play.

In your opinion how active do you think the children are?

BS01: I think it depends on their personality [how active they are]. Some children have a need to exert energy more than others, but generally speaking, it's not a bad space. They seem to go a bit crazy at the beginning of play then lose a bit of power, a bit of energy and click into a game at the end and less random running.

What if anything do you think effects what they play and how active they are?

BS01: It depends, sometimes if they have clicked in to something they have done in the classroom, or in a dance lesson, they will imitate it outside as best they can, without the equipment and things, so sometimes they are captured by something they have been taught. But generally speaking I think it's just popular culture. Is that the kind of thing you meant?

Yeah and if there are things like adults present.

BS02: Yeah I do, especially if you prompt them a little bit in the right direction, they may be a bit more strategic than just random rules

Moving on to talking a little bit about playground markings, like hop scotch and big snakes and ladders and things like that. What is your opinion on these being installed, is it going to be a good thing do you think?

BS02: Yes, we are looking forward to it [installation of markings]. Largely because it does form a focal point, a central point for the children that are less active, and those children that have taken them self off and don't feel included, a teacher can quickly initiate a game. It's a stimulus; it's a prompt to get them thinking, getting them sociable and active.

Do you think it looks a little more inviting as well?

BS02: yes, and on those days when they can't think of what to do, it can get them started. It will be interesting to see how that changes playtimes, I think behaviour will improve; in they will be more occupied, whether that's more actively occupied or just calmer I'm not sure.

How do you think the children will react?

BS02: initially they will be really excited. Initially they will, but things change, like the wagon in here, in September it was the best thing they had ever seen, and now, they have sat in this room everyday for 14 weeks. Even though markings are permanent we can change the way we use them, it's about keeping things fresh and positive.

So they may be more of a novelty at first and then you can find different ways of using them?

BS02: although... if they're [the playground markings] something that they can see value in then it will last, like in the old school, it's not markings, but we had a trim trail, like a climbing trail thing, and they loved that and were obsesses with that for years, and they always loved it. Like hopscotch will always be popular. But the spiral shapes, they walk around it once and then don't know what to do with it. They need a bit of help to make the most of it really.

The company that is putting them in is providing training for supervisors to learn different games and prompts you do to encourage the children, so lots of different activities, do you think that would be valuable.

BS02: [training will be] really valuable, because no matter how long you have been teaching you've only got the experience you've come from, so finding new ways of playing games and things, that would be brilliant. Having the knowledge of how to use them, like the spiral things threes probably a million things you could do on there.

Do you think your pupils are encouraged to be active at playtime, or more free-play?

BS02: yes, you do get those children that come and grab your hand and want to stand with you and even though it is nice to have that relationship and some need nurturing more than others, they need to start having more independence and you do say go and have a play, you know there's someone over there go and play with them, and you do pair those children off and encourage them to go off rather than holding onto your hand at playtime. There are

certain limitations like the mound at the back saying stop you have to come off the grass for is stopping them in some way but you have a line for health and safety reasons.

Appendix 9: Interview Transcript – School C – Participant CS01

Date: 24.01.12

In your opinion how do you think children spend their playtimes?

Running around

Do you think they are very active?

Yeah [they are active]

Do you think some children are more active than others?

Some [children are more active then others]

What is your involvement ate playtime?

Supervising

More specifically, what kind of activities do you think they do at playtime?

They make up games, chase each other, shoot each other

Do you think over all, that they are quite active at playtime?

Yeah, they need it

In regards to playground markings, do you think that they make much difference to them playing?

Only a few use them I've seen

Do they play more games on them? Make up games?

I think they make them up pretty much

And do you think the playground supervisors encourage them that much to use them?

No [supervisors don not encourage play]

Do you think if the playground supervisors that are out all the time, if they were trained to do games on them, would use them more?

Probably, 'cus they'd have games on them

Is there anything you can think of that would make children more or less active?

Make games around their interests, like BEN 10 and stuff like that, what's popular.

Appendix 10: Interview Transcript – School C – Participant CS02

Date: 27.01.12

In your experience, quite a broad question, how do you think the children spend their playtime?

A lot of running around, playing chase, the girls like to play what's the time Mr Wolf, but they are pretty much always on the move in other times.

What is your involvement in these play times?

Things like showing them how to play what's the time Mr Wolf, giving them equipment to play with, set up a general game, but only during afternoon play, that's the only one I go out for

In your opinion do you think there are some groups of pupils that are more or less active then others?

I'd say that yeah [some groups of pupils are more active], there are definitely a couple, you've got the certain group that always go for the climbing frame, or are running around

Do you think they are very active at playtime?

Yeah at playtimes they are very active

What do you think if anything, would impact, whether there are adults around for example, what do you think would impact how they spend their playtimes? Like play equipment being out?

Yeah play equipment [affects how they spend their playtime]. If you put a box of books they would all go for the box of books but of you put equipment they would be running around. In summer we have to trim-trail as well.

In the playground there's quite a lot of playground markings, do you think they make a lot of difference

I'd say not so much when they are playing but you sometimes set up games using the squares, I think, it gives them areas, rather than running round aimlessly,

The company, that installs markings, does playground training as well, training to encourage games that use the markings. Do you think that would be useful for the supervisors?

Yeah definitely [training would be beneficial], if they knew what to play and knew how to play and had the ideas it then they would

Do you think there's a lot of encouragement at the moment?

No not really I think they should be a bit more focus and a bit more directed, and then they would know what they could play and how to play it.

Appendix 11: Interview Transcript – School D – Participant DS01

Date: 24.02.12

In your opinion, thinking about the foundation class, do you think they are very active during lunchtime and break time?

What I see at lunchtime yes, and I know some of the boys love running games and they have races to the shed, tap it and run back and are quite competitive like that, and some of the girls play hopscotch. The little ones, they are learning to skip. I mean one of the year ones, last year she could not skip and she practiced and practiced... and they use the hoops. Like I say the young leaders, when they're out, lots of the little ones play with them and they play games like stuck in the mud, and that sort of running and tig games.

Would you say most of them are quite active out on the playground?

Yes I would say so, not many of them are static and standing around

What games, you said running and chasing games, do you think they are the most popular type of games?

They like that [running and chasing games]; you just have to be a little bit careful about where they go. Some of the older ones when they play football, you just watch the area. And there's another game we play, three of the young leaders are very good at this and it's called tadpoles. You are like in two teams.

So it's competitive?

Oh yes [competitive games], the first, like team A can be the tadpoles eye and team B can be the tadpoles tail. And the eye is the young leader in the middle to throw and catch the ball all the way round, and while they are doing that there's 4 posts and they run twice round it, and stop. And how many you've got you swap over and you've got to try and beat it. They love that game.

Is it a kind of mixture of age groups of children or is it the older ones and younger ones?

The young leaders are pretty good with the young ones, we don't get so many 3/4s joining in, and some do but mainly its key stage 1. But yeah we have running games and all sorts. And the little goal, that's not running so much but they love that, who can get the goal, yeah. Yeah we do, they all like that.

Do you think from the foundation classes some groups of children are more active than others, like the girls more than the boys or the boys more than the girls?

Boys [are more active], they love the running and the chasing, there's one or two girls that join in and ask [to play with the boys]. And the games and running races, like that.

Is it different the games that they play?

The girls like the skipping ropes and things like that, sometimes they will have a go at tennis, but the boys yeah they are running races, tig, stuck in the mud, anything like that.

Would you say that the boys are more stereotypical boy games and the girls more adhere to the stereotype?

Yeah, probably [boys and girls play stereotypical games]. They do, I mean some of the boys like hopscotch. One little boy today joined in with the skipping ropes. They love the colour games as well, boys and girls, that's just a skipping rope and they choose a colour and the others they all line up and they keep the skipping rope on the ground and take it in turns jumping over and whoever guesses the colour they are thinking of goes next. The boys and girls like the tadpoles' game, boys and girls like leg goals.

So you think it is quite mixed?

Yes [actcities are mixed]

Do you think equipment makes a difference to how active they are out there; do you think they would be as active if they didn't have so much stuff?

Probably not, cus I mean we do try to get plenty of games going and in the summer time its lovely cus we have all the field, there's football going on, rounder's going on, cricket, rugby.

So the is quite a lot of emphasis on getting them active?

Oh yes, we are all like that, it's the same as the after school club, (teacher) is quite sporty, she is. And we have people coming in and doing all the multi-skills and they join in and do that with them. Some of them even if they don't join in, in the summer they walk the whole way round the field and find all different things to do.

'Cus it's quite a big space?

Oh it's huge, yeah, there's plenty of running about, they all like the trim trail and when its nice weather they play on the pirate ship and their imagination there, some of them are crocodiles.

Do you think using their imagination is quite a big thing?

Oh yes, yeah yeah [using imagination is important], yeah I think the girls they, well the boys they say when they are on the pirate ship oh I'm the captain oh I'm the crocodiles. Some of

the girls play castles and I know some of the girls are into rapunzel and playing princesses. They are all quite active. You don't see many that are just sat down.

One of the things I am looking at in particular, are the markings on the ground like the hopscotch and squares and things like that, do you think that they make a difference, do they interact with the markings or is it more about the play equipment.

I mean they do use them, but I should say, the hopscotch but no I think they play more with equipment and when the young leaders are out and doing games with them I think they are more focussed on that

DO you think if you had games that were directed using the markings, then they would use them more?

They might do [use the markings if directed], yeah probably, if you lead them and don't sort of organise it I don't think they would bother, but if you lead it get them in circles and things. If you are not there they will just run off and play but they don't use them a lot no.

Do you think it makes the playground look more inviting and colourful?

Oh yes, there is, there's that [the markings make the playground more inviting] and everything we've got and I think we are lucky with the big area that we've got

Last thing really, the training do you think that helps, training up the year 6 leaders? Another thing that schools are doing is training playground supervisors, to encourage games; do you think that would make a difference?

Oh it does [help having young leaders].

Just having that adult there to guide them the leaders as well?

Yeah, yeah, yeah, they do yeah, and then they explain the game to them and then you often get, I know these started in September and you getting them a bit nervous starting up cus it's such a massive area, and you've got all the older ones there, but having the older ones, a lot of them come running out wearing the young leaders, and they play lots of difference games with them. But yes.

Do you think there are any things that potentially make them less active? Things like weather? Things that really affect the children? Or no matter what go and have a run around?

Yeah even if it's spitting, and we can't have a lot of equipment they love just running and all the markings for like netball and they do games like follow the leader and go up and down the lines and circle games with them I know they like duck duck goose all those sorts of things. It's a mixture 'cus in the bad weather the trim trail and the pirate ship, 'cus everything's made of wood they can't go on it, so then they are confined to the playground, if it is wet, certain equipment, we try to do as much as we can with certain equipment, even just a ball or running games. There's another game they play, chicken pie, they play that with the young leaders. And there's someone in the middle and they run and they have to be different things and there's different actions to different things.

Are all these things taught, are all the young leaders, brought together and taught together or are they just games they know off the top of their head?

I have taught some and then the Lincoln city and someone came in from Lincoln city football, and they taught so many of them and I showed them so many games. Like how to speak to the children and how to organise everything and zone the playground, so they are all taught and then there's a massive book with over200 games in so they can have a look and get a copy if they like. French skipping they like that and a lot of the older girls like that and play that quite a lot and there's books there. And they love their football and hockey and as I say in the summer they have the whole of the field, and if they are interested and playing a game there are less injuries if they are doing something and les falling out

Do they interact more socially with each other as well?

Yeah, yeah, but I mean they even silly things, like when they come and cut the grass in the summer and then they build nests and houses and you get someone come along, and I have them in tears come to me, they've stolen some of my grass! But when there's plenty of things going there's none of that cus they are all busy. I think we are quite and active school with different clubs and things and people coming in

So the children are encouraged to be active a lot?

Oh yeah [children are encouraged to be active], we have the healthy eating, you know everything yeah, we have the judo people come in and teach judo and the multiskills and then I did the young leaders.

Appendix 12: Interview Transcript – School D – Participant DS02

Date: 21.02.12

How active do you think the children are at break time and lunch time, do you think they are very active?

Half of them, most of them, I know the children that like to stay with the adults and do quieter activities. But as a class on a whole I think they are active and like running around. I mean most children do at this age but there are the odd few that do stay by an adult at time, a bit more and they do need more confidence to go off. But this year they are one of my most active classes, when they first come it is quite daunting to go into the big playground. What we usually do is corner of a part of the playground, like cone some off at lunchtime so that's just their area. But this year it's been one of the years when no one has just played in that area and explored the whole playground. Last year we had children who didn't want to go outside cus there where loads of children.

Do you think it's an age thing?

I think it's all about the confidence, they are quite a confident class this year and they have gelled quite well together, from the little learners coming through they have kept the friendship groups and I think that's helped them when they are on the playground. I think its confidence to how active they are on the playground.

What kind of activities do you think they mainly participate in?

Like chasing games, games like the young leaders have introduced, I know sometimes, duck, goose, what's the time Mr. Wolf. Sometimes they need an older person or like an adult to kind of start that game before they start, especially the boys I do think they play like a lot of things that they see like transformers and power rangers, and things they see on the telly.

And then it depends equipment wise, sometimes they play tennis, but mainly chasing games and things like that, tig and for the girls skipping or something like that.

Do you think at the younger age using the imagination is important?

It's a big part of it [using imagination], even though we've got out there like the pirate ship and things which are quite structured they still turn into different things, like the boys especially like power rangers transformers and the girls like princesses but I do think imagination is important. Like sometimes we go out there with no equipment but they still seem to make up their little games and be happy doing that with no equipment.

Your playground has markings on the playground, one of the things I'm looking at in particular, do you think they make much of a different to playtime, if they weren't there do you think it would make much difference to how active they are?

To be honest no [the markings do not make much difference to how active they are], I don't think they would, obviously we've got a netball court and numbers and things, which is good for us as teachers and we go and do learning on them, the main thing that helps on the playground is the hopscotch's, the children like the hopscotch's, the other things I don't think they use as much. I think you've got to know how to use them, be there to try and make a game up with them, they are good for us, but the children don't really know how to act with them, not at a young age anyway. The older children know more different games and things. I think the hopscotch's and the little square on cus they will jump in and out of them, but I think they would still be as active without them on the playground.

Do you think then one of the most important thing to use them and play games is an adult?

Yeah, I have used the number on a lot in maths, and done different things and put equipment on and used them for number bonds. I think like playing like bean bag games with the hoops. I think us as teachers and adults you need to model them and then provide the equipment for them to use them again. Hopscotch is a really good one as children know how to play that so children will go and use them themselves. But the other ones they need some kind of guidance on what they are going to do. They like the lines, they just like the lines to be honest, like they will follow the netball court lines, even though they don't know

it's a netball court, but they will do things like that. So they do use them, but not really in a way that they are intended.

So more guidance really?

Yeah [children need more quidance].

What things do you think make a difference, like one thing we have said is having guidance there; do you think any other things make a difference to how active they are? Or what activities they play?

I think having the young leaders and starting off games is a good one, then it gets more children involved, especially having so many people out there at lunchtime some of them shy off more, at lunchtime rather than playtime cus the older ones are out there. I just think having a big space for them to be able to go along. I think the trim trail helps as well, sometimes it's hard to get on it and it's slippery and stuff, they all go to go to it, but I think just having the big space. In the summer it's even better because we can open up more space with the fields. I think the more space they've got really the more active that they are. If they are confined to one little playground it's hard. I'd say equipment helps but not always, I'd say that they are playing as well if they haven't got anything there.

Do you think the weather makes a difference?

Yeah, it [the weather] makes a big difference on the children's attitude. Like if it's windy the children are all hyper anyway, or if it's raining some of them love the rain, but we don't always get to go out if it's that wet. And then obviously that's different to how active they are back inside. Its hard for them, they want to release their energy but they can't, so it's difficult. Also I notice a difference on the playground when it's sunny and it's calm the children just seem to get on and there's no accidents no falling out, but when it's windy and there all WOOOO it's a hectic playtime and you feel it yourself, but I don't know if that effects how active they are, I think it just effects their attitude.

Are there any groups of children that play together or are more active than others?

I think they tend to stick to the same friendship groups when they are outside, I think that the boys are more active because they are more rough and tumble, they play games and the games that they tend to play are more chasing and it is the girls that sit down and talk and make up games than it is the boys, I think they stick to mainly the same friendship groups unless they want to play something completely different.

Appendix 13: Example SOCARP Data collection Sheet

Date:

School:

Target Child Number:

Observer ID:

Study:

Recess Period:

Recess Time Start:

Additional Notes:

Recess Time End:

Adult Supervisors:

Equipment:

Child Start Time:

Child End Time:

Target Child Gender: Male / Female

Reliability: Yes / No

Observation	Child Activity	Group Size	Activity Type	Interaction	Notes
1	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
2	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
3	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
4	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
5	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
6	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
7	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
8	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
9	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
19	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
11	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
12	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
13	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
14	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
15	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
16	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
17	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
18	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
19	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
20	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
21	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
22	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
23	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
24	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
25	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
26	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
27	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
28	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
29	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	
30	1 2 3 4 5	A S M L	SP G S L	N PS VS PC VC I	